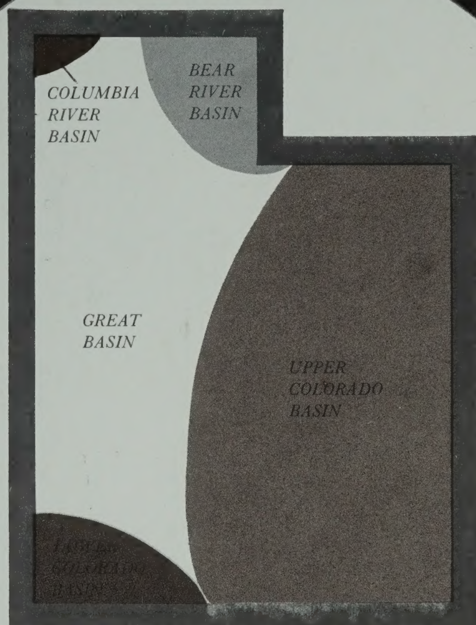

DEVELOPING A STATE WATER PLAN

GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1971

COOPERATIVE INVESTIGATIONS REPORT NO. 9

UTAH DIVISION OF WATER RESOURCES — U.S. GEOLOGICAL SURVEY

DEVELOPING A STATE WATER PLAN

GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1971

by

R. M. Cordova and others

United States Geological Survey

Prepared by the United States Geological Survey

in cooperation with the State of Utah

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GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1971

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U.S. Geological Survey

INTRODUCTION

This report is the eighth in a series of annual reports that describe ground-water conditions in Utah. Reports in the series are prepared cooperatively by the U.S. Geological Survey and the Utah Division of Water Resources and are designed to provide data for interested parties, such as legislators, administrators, and planners, to keep abreast of changing ground-water conditions.

This report, like the others (see references, p. 21), contains information on well construction, ground-water withdrawals, water-level changes, and related changes in precipitation and streamflow. It also contains supplementary data that are related to ground-water use in some areas. In reports of this series, the inclusion of such supplementary data as graphs showing chemical quality of water and maps showing water-table configuration is intended only for those years or areas for which applicable data are available and are important to a discussion of changing ground-water conditions.

The report includes individual discussions of the most important areas of ground-water withdrawal in the State for the calendar year 1970. Water-level fluctuations, however, are described for the period spring 1970 to spring 1971. Many of the data used in this report were collected by the Geological Survey in cooperation with the Division of Water Rights, Utah Department of Natural Resources.

The following reports dealing with ground water in the State were released by the Geological Survey during 1970:

Compilation of basic data for water-supply exploration and development on the public domain under the soil and moisture conservation program, 1941-67, by Derald Dunagan and D. A. Webster: U.S. Geol. Survey open-file rept. (Plate 9 - Map showing well sites examined and wells drilled on public lands - Utah)

Geohydrology of the area near WOSCO (Western Oil Shale Corp) exploratory hole number 1, Uintah County, Utah, by J. E. Weir, Jr.: U.S. Geol. Survey open-file rept.

Geólogy and water resources of the Spanish Valley area, Grand and San Juan Counties, Utah, by C. T. Sumsion: Utah Dept. Nat. Resources Tech. Pub. 32 (In press).

Ground-water conditions in the central Virgin River basin, Utah, A progress report for 1968-69, by R. M. Cordova, G. W. Sandberg, and Wilson McConkie: U.S. Geol. Survey open-file rept.

Ground-water conditions in Utah, spring of 1970, by C. T. Sumsion and others: Utah Div. Water Resources Coop. Inv. Rept. 8.

Ground-water inflow toward Jordan Valley from Utah Valley through valley fill near the Jordan Narrows, Utah, by R. W. Mower, in Geological Survey Research 1970: U.S. Geol. Survey Prof. Paper 700-B, p. B199-202.

Ground water in Tooele Valley, Utah, by J. S. Gates and O. A. Keller: Utah Dept. of Nat. Resources Water Circ. 2.

Hydrologic reconnaissance of Grouse Creek valley, Box Elder County, Utah, by J. W. Hood, and Don Price, 1970: U.S. Geol. Survey open-file rept.

Hydrologic reconnaissance of Hansel Valley and northern Rozel Flat, Box Elder County, Utah, by J. W. Hood: Utah Dept. Nat. Resources Tech. Pub. 33 (In press).

Hydrologic reconnaissance of the Sink Valley area, Tooele and Box Elder Counties, Utah, by Don Price and E. L. Bolke, 1970: Utah Dept. Nat. Resources Tech Pub. 26.

The pre-Quaternary surface in the Jordan Valley, Utah, by Ted Arnow, Richard Van Horn, and Reed LaPray; in Geological Survey Research 1970: U.S. Geological Survey Prof. Paper 700-D, p. D257-D261.

The Raft River basin, Idaho-Utah, as of 1966: A reappraisal of the water resources and effects of ground-water development, by E. H. Walker, L. C. Dutcher, S. O. Decker, and K. L. Dyer: U.S. Geol. Survey open-file rept.

Water Resources of Salt Lake County, Utah, by A. G. Hely, R. W. Mower, and C. A. Harr: Utah Dept. Nat. Resources Tech. Pub. 31 (In press).

Water-resources appraisal of the lower Virgin River valley area, Nevada, Arizona, and Utah, by P. A. Glancy and A. S. Van Benburgh: Nevada Dept. Conserv. and Nat. Resources Water Resources Reconn. Ser. Rept. 51., 87 p., 2 pls.

Water resources of the Heber-Kamas, Park City area, north-central Utah, by C. H. Baker, Jr.: Utah Dept. of Nat. Resources Tech. Pub. 27.

UTAH'S GROUND-WATER RESERVOIRS

Small quantities of ground water can be obtained from wells throughout much of Utah, but large supplies that are of suitable chemical quality for irrigation, public supply or industrial use, generally can be obtained only in specific areas. These areas of known or potential ground-water development are shown in figure 1 and named in table 1. Only a few wells outside of these areas yield large supplies of water of good chemical quality.

Less than 2 percent of the wells in Utah obtain water from consolidated rocks. The consolidated rocks that yield the most water are lava flows such as basalt, which contains interconnected vesicular openings or fractures; limestone, which contains openings enlarged by solution; and sandstone, which contains interconnected openings between the grains that form the rock. Most of the wells that tap consolidated rocks are in the eastern and southern parts of the State, in areas where water supplies cannot be readily obtained from unconsolidated rocks.

More than 98 percent of the wells in Utah draw water from unconsolidated rocks. These rocks may consist of boulders, gravel, sand, silt, or clay, or a mixture of some or all of these sizes. Wells obtain the largest yields from the coarser materials that are sorted into deposits of equal grain size. Most wells that tap unconsolidated rocks are in large intermountain basins, which have been partly filled with debris from the adjacent mountains.

TABLE 1

Areas of known or potential ground-water development in Utah

(locations are shown in fig. 1)

	Area	Type of water-bearing rocks
1.	Curlew Valley	Unconsolidated
2.	Park Valley	Do.
3.	Grouse Creek Valley	Do.
4.	Hansel Valley	Do.
5.	Blue Creek Valley	Do.
6.	Sink Valley	Do.
7.	Malad-Lower Bear River Valley	Do.
8.	Valley east of the Pilot Range	Do.
9a.	East Shore area, Weber Delta and Bountiful districts	Do.
9b.	East Shore area, Brigham district	Do.
10.	Jordan Valley	Do.
11.	Cache Valley	Do.
12.	Bear Lake Valley	Do.
13.	Upper Bear River Valley	Do.
14.	Ogden Valley	Do.
15.	Morgan Valley	Do.
16.	Park City area	Do.
17.	Kamas Valley	Do.
18.	Heber Valley	Do.
19.	North flank Uinta Mountains	Do.
20.	South flank Uinta Mountains	Do.
21.	Uinta Basin	Do.
22.	Tooele Valley	Do.
23.	Skull Valley	Do.
24.	Dugway area	Do.
25.	Fish Springs Flat	Do.
26.	Sevier Desert	Do.
27.	Rush Valley	Do.
28.	Cedar Valley	Do.
29.	Utah and Goshen Valleys	Do.
30.	Juab Valley	Do.
31.	Sanpete Valley	Do.
32.	Central Sevier Valley	Do.
33.	Upper Sevier Valleys	Do.
34.	Deep Creek Valley	Do.
35.	White Valley	Do.
36.	Snake Valley	Do.
37.	Pine Valley	Do.
38.	Wah Wah Valley	Do.
39.	Escalante Valley, Beryl-Enterprise district	Do.
40.	Escalante Valley, Milford district	Do.
41.	Beaver Valley	Do.
42.	Cedar City Valley	Do.
43.	Parowan Valley	Do.
44.	Upper Fremont Valley	Do.
45.	Lower Fremont Valley	Consolidated
46.	Spanish Valley	Unconsolidated
47.	Castle Valley (Grand County)	Do.
48.	Montezuma Creek area	Consolidated
49.	Kanab area	Unconsolidated
50.	St. George area	Do.
51.	Pavant Valley	Do.
52.	Colton area	Consolidated
53.	Scipio area	Do.
54.	Lisbon Valley	Do.
55.	Monticello area	Do.
56.	Blanding area	Do.
57.	Bluff area	Do.

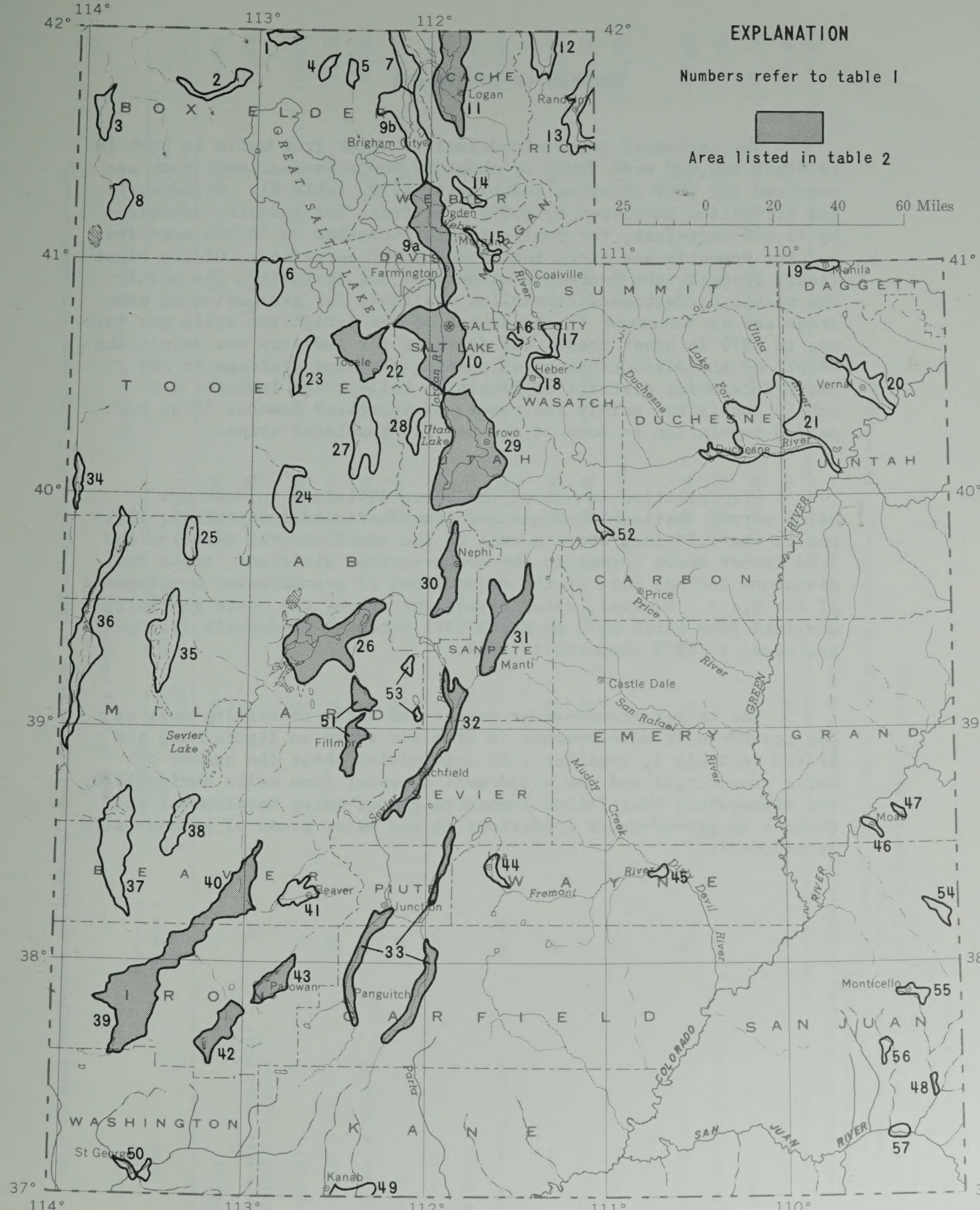

Figure 1.—Map of Utah showing areas of known or potential ground-water development.

SUMMARY OF CONDITIONS

The estimated total withdrawal of water from wells in Utah in 1970 was 680,000 acre-feet, or about 10,000 acre-feet more than was reported for 1969 (Sumsion and others, 1970, table 2). Withdrawal for irrigation increased by 6,000 acre-feet, for industry decreased by 13,600 acre-feet, for public supply increased by 16,100 acre-feet, and for domestic and stock increased by 400 acre-feet. Of the significant changes, the increased withdrawal for irrigation was mainly the result of decreased streamflow available for irrigation in some areas and an increase in the number of new irrigation wells put into use in 1970 in other areas; the decrease for industry was mainly the result of the discontinuance of pumping for mine drainage in the Beryl-Enterprise district of Escalante Valley; the increase for public supply was mainly the result of increased demands of an expanded population in some of the heavily populated areas.

Precipitation in four of the seven divisions in Utah was below normal (National Oceanic and Atmospheric Administration, 1971) but it was 0.16 inch above normal in the south-central division and 3.96 inches above normal in the north-central division: these two divisions include most of the major areas of ground-water development of the State. However, water levels throughout the State generally declined from March 1970 to March 1971 because withdrawals from wells increased in 1970 compared to 1969.

The larger ground-water basins and those containing most of the ground-water developments in Utah are shown in figure 1 and are listed in table 2, together with information about the number of wells constructed and the withdrawal of water from wells during 1970. The discussions that follow summarize ground-water development and changes in ground-water conditions in the major areas of ground-water development.

Table 2.--Well construction and withdrawal of water from wells in 1970 in major areas of ground-water development in Utah.

Area	Number in figure 1	Number of wells completed 1/: Diameter: Less than 6 inches 2/	Number of wells completed 1/: Diameter: 6 inches or more 2/	Number of wells completed 1/: New large-withdrawal wells 3/	Withdrawal from wells (acre-feet): Irrigation	Withdrawal from wells (acre-feet): Industry	Withdrawal from wells (acre-feet): Public supply	Withdrawal from wells (acre-feet): Domestic and stock	Withdrawal from wells (acre-feet): Total (rounded)
Cache Valley	11	6	10	7	12,800	7,000	2,900	2,100	24,800
East Shore area, Weber Delta and Bountiful districts	9a	19	14	6	4/17,000	6,400	15,600	-	39,000
Jordan Valley	10	10	28	3	3,200	38,400	40,300	5/33,500	115,400
Tooele Valley	22	0	17	3	4/21,400	700	2,600	100	24,800
Utah and Goshen Valleys	29	20	50	7	51,900	6,800	11,300	12,700	82,700
Juab Valley	30	0	3	1	17,900	50	0	150	18,100
Sevier Desert	26	11	1	1	11,400	600	1,300	1,000	14,300
Sanpete Valley	31	5	9	2	10,100	400	500	6/3,500	14,500
Upper and central Sevier Valleys	32,33	11	5	0	11,600	100	1,500	6,100	19,300
Pavant Valley	51	6	12	12	70,200	0	100	300	70,600
Cedar City Valley	42	0	9	0	1/30,000	1/500	1/800	1/150	1/31,400
Parowan Valley	43	0	9	4	1,7/25,300	0	1/100	1/150	1/25,600
Escalante Valley									
Milford district	40	0	2	2	1/55,300	1/100	1/600	1/600	1/56,600
Beryl-Enterprise district	39	0	15	1	1/69,300	1/0	1/100	1/600	1/70,000
Other areas		9	135	16	8/59,700	8/2,100	8/9,100	8/1,000	8/71,900
Totals (rounded)		97	319	65	467,000	63,200	86,800	62,000	680,000

1/ Data from Utah Department of Natural Resources, Division of Water Rights.
2/ Includes replacement wells.
3/ New wells (6 inches or more in diameter) constructed for irrigation, industrial, or public supply.
4/ Includes some domestic and stock use.
5/ Includes some use for fish and fur culture and air conditioning.
6/ Includes some use for irrigation.
7/ Includes some use for stock.
8/ Estimated minimum amount.

MAJOR AREAS OF GROUND-WATER DEVELOPMENT

CACHE VALLEY

by L. J. Bjorklund and L. J. McGreevy

The withdrawal from wells in 1970 was about 24,800 acre-feet compared to 25,600 acre-feet in 1969 (Sumsion and others, 1970, p. 10). Withdrawal for irrigation in 1970, however, was slightly greater than it was in 1969 owing to increased use of flowing wells in 1970.

Water levels in wells in Cache Valley generally changed little from March 1970 to March 1971 and in most of the valley the rise or decline was less than 1 foot (fig. 2). Changes of more than 1 foot occurred locally.

The long-term trend of the water level in well (A-12-1)29cab-1, near Logan, the annual discharge of the Logan River near Logan, and the cumulative departure from the 1931-60 annual precipitation are shown in figure 3 for comparison. The water level in well (A-12-1) 29cab-1 was nearly the same in March 1971 as it was in March 1970 although precipitation was substantially greater in 1970 than it was in 1969 (fig. 3). However, the discharge of the Logan River increased slightly in 1970 because of the above-normal precipitation.

EAST SHORE AREA, WEBER DELTA AND BOUNTIFUL DISTRICTS

by E. L. Bolke

The withdrawal from wells in the East Shore area in 1970 was about 39,000 acre-feet or 9,400 acre-feet less than that reported for 1969 (Sumsion and others, 1970, p. 11). Most of the difference between the withdrawal reported for 1969 and that for 1970 is due to more accurate determination of the amount of withdrawal (reported as irrigation withdrawal) from small-diameter multipurpose wells. The combined withdrawal from wells used for public supply and industry increased by 1,000 acre-feet from 1969 to 1970.

Water levels declined in most of the East Shore area from March 1970 to March 1971 (fig. 4). The greatest declines occurred northwest and southwest of North Ogden and in a large area southwest of Ogden including most of Hill Air Force Base. The greatest rises occurred in areas north and west of Bountiful.

The long-term relation between precipitation and water-levels in wells is illustrated in figure 5. The decline of water levels in the wells near Layton, Clearfield, and Ogden probably resulted from increased withdrawal from public supply and industrial wells in the Weber Delta district. The rise of water level in the wells near Bountiful probably resulted from above-average precipitation and decreased withdrawals from public-supply and industrial wells in the Bountiful district.

JORDAN VALLEY

by C. T. Sumsion

The withdrawal from wells in Jordan Valley in 1970 was 115,400 acre-feet, an increase of 6,400 acre-feet or about 6 percent over that reported for 1969 (Sumsion and others, 1970, p. 12). The largest increase in withdrawals was for public supply which used 40,300 acre-feet, or 9,500 acre-feet more than the amount used in 1969. The increase was due to a larger population (fig. 6) and to above-normal temperatures during 1970 which resulted in more lawn watering than during 1969. The mean annual temperature recorded during 1970 at the Salt Lake City WSFO (International Airport) station was 0.6°F (0.3°C) greater than normal. The withdrawal for industry decreased by 2,000 acre-feet; and the withdrawal for irrigation was 30 percent less than in 1969 due to increased availability and use of surface water.

Water levels rose from February 1970 to February or March 1971 in about 92 percent of the Jordan Valley (fig. 7) and declined in about 8 percent; the net average change in the valley was a rise of 0.9 foot. The maximum observed rise was slightly more than 6 feet in a small area in northern Salt Lake City, and the maximum observed decline was slightly more than 4 feet near the center of the valley. The maximum rise occurred in an area where the average annual pumpage during 1967-69 was less than 50 percent of the average annual amount for the prior several years. The maximum decline was due to increased pumpage for public supply and industrial uses in an area relatively distant from its recharge area.

The long-term relations between fluctuations of precipitation and water levels are illustrated in figure 8. Precipitation at Silver Lake Brighton during 1970 was 11.36 inches above normal, and this increase is shown by the continued steep rise in the precipitation graph. The above normal precipitation and only moderately increased withdrawals in most parts of the valley are reflected by a rise of water levels in four of the five wells. The decline in well (C-2-1)24adc-1 in the Cottonwoods district represents the local effect of increased withdrawals for public supply.

TOOELE VALLEY

by L. R. Herbert

The withdrawal of 24,800 acre-feet of water from wells in Tooele Valley in 1970 was about 1,600 acre-feet more than reported for 1969 (Sumsion and others, 1970, p. 13). The increase resulted mainly from greater withdrawals by pumped irrigation and public-supply wells.

The discharge from springs in 1970 was approximately 13,400 acre-feet. Of this amount, about 2,200 acre-feet was used for irrigation and stock in the valley, and about 11,200 acre-feet was diverted to Jordan Valley for industrial use.

Water levels rose in most of Tooele Valley from March 1970 to March 1971 (fig. 9), due partly to above-normal precipitation in 1970, partly to increased availability of surface water for irrigation, and partly to less water being pumped locally in 1970 than in 1969. In the areas where declines occurred, more water was withdrawn in 1970 than in 1969.

The long-term relation between water levels in selected wells and precipitation at Tooele is shown in figure 10. The precipitation at Tooele in 1970 was 4.74 inches more than the 1931-60 normal, and as a result, water levels rose in four of the seven selected wells. Declines which occurred in areas influenced by local pumping are shown by water levels in the three other selected wells.

UTAH AND GOSHEN VALLEYS

by R. M. Cordova

The withdrawal from wells in Utah and Goshen Valleys in 1970 was 82,700 acre-feet or 4,600 acre-feet more in Utah Valley and 600 acre-feet more in Goshen Valley compared to 1969 (Sumsion and others, 1970, p. 14). Runoff from the drainage areas supplying water to Utah Valley was less during 1970 than during 1969; thus more supplemental water was needed from wells in 1970. Also, more water was needed for an expanding population. In Goshen Valley, part of the increase in withdrawal was the result of an increase in the amount of cultivated land north of Elberta.

From March 1970 to March 1971, water levels declined in most of Utah Valley even though precipitation was above normal in 1970, but levels rose in most of Goshen Valley (fig. 11-15). The declines in Utah Valley resulted from the increased withdrawal from wells. The general rise in Goshen Valley (fig. 11) was a result of decreased withdrawal in the area of rise; the declines north of Elberta resulted mainly from increased withdrawal in that area.

JUAB VALLEY

by R. G. Butler

The withdrawal from wells in Juab Valley in 1970 was about 18,100 acre-feet, 300 acre-feet more than that reported for 1969 (Sumsion and others, 1970, p. 14). The increase resulted from more water being pumped from large-diameter irrigation wells.

From March 1970 to March 1971 water levels declined in all but two observation wells (fig. 16). The greatest declines occurred in the heavily pumped areas, about 4 miles north of Mona, at Nephi, and at Levan, where water levels in March 1971 were more than 3 feet lower than they were in March 1970. The general decline of water levels resulted from ground-water discharge exceeding recharge.

The long-term relation in Juab Valley between water levels in selected wells and the cumulative departure from the 1931-60 normal annual precipitation is shown in figure 17. Water levels declined in the two wells from March 1970 to March 1971 although precipitation in 1970 was above normal, indicating that total discharge locally exceeded recharge.

SEVIER DESERT

by R. W. Mower

The withdrawal from wells in the Sevier Desert in 1970 was 14,300 acre-feet, about 6,600 acre-feet less than was reported for 1969 (Sumsion and others, 1970, p. 15). Pumpage for irrigation in 1970 decreased 38 percent from the amount in 1969 because surface water was more plentiful in 1970.

Water levels from March 1970 to March 1971 in both the lower and upper artesian aquifers rose in most parts of the Sevier Desert (figs. 18 and 19) but declined in some of the northern part. The maximum rise in the lower artesian aquifer was slightly more than 2 feet near Delta. The maximum rise in the upper artesian aquifer was slightly more than 2 feet in a small area about 3 miles north of Oak City. Water-level declines in both aquifers were less than 1 foot.

During 1970 the precipitation at Oak City was 4 percent above normal and probably resulted in slightly above-normal recharge. This was the sixth of the past 7 years that precipitation, and probably recharge, was above normal. Water levels rose in the three observation wells for which hydrographs are shown in figure 20, suggesting that the withdrawal from wells in 1970 was less than the recharge in some parts of the Sevier Desert.

SANPETE VALLEY

by R. G. Butler

The withdrawal from wells in 1970 in Sanpete Valley was about 14,500 acre-feet or 300 acre-feet less than that reported for 1969 (Sumsion and others, 1970, p. 16). The difference is due mainly to a decrease of about 500 acre-feet of water pumped for irrigation in the Fountain Green area.

Water levels generally declined from March 1970 to March 1971 in Sanpete Valley (fig. 21); the greatest decline occurred in the flowing well (D-14-2)13aaa-1 near Fountain Green. This well is 75 feet deep and the pumped irrigation wells in the area are generally more than 200 feet deep. The decreased amount of water pumped from the deeper irrigation wells did not result in a water-level rise in the shallow flowing well.

Hydrographs of water levels in two pumped irrigation wells and one small-diameter flowing well in Sanpete Valley and the long-term trend of precipitation at Manti are shown in figure 22. Water levels declined in all three wells although precipitation was above normal. More water was pumped for irrigation in the Ephraim and Mount Pleasant areas during 1970 than in 1969, and that may account for the decline of water levels in those areas.

THE UPPER AND CENTRAL SEVIER VALLEYS

by G. W. Sandberg

The withdrawal from wells in the upper and central Sevier Valleys was about 19,300 acre-feet in 1970, a decrease of 200 acre-feet compared to the amount reported for 1969 (Sumsion and others, 1970, p. 16). Water levels rose in seven wells, declined in 22 wells, and remained the same in one well from March 1970 to March 1971 (fig. 23).

The relations among water levels in selected wells, average annual discharge of the Sevier River at Hatch, and precipitation at Piute Dam and Panguitch are shown in figure 24. Although precipitation at Panguitch was above normal in 1970, the small amount of snow in the headwater area of the Sevier River caused the lowest discharge on record in the Sevier River at Hatch. The decreased discharge resulted in a lower water level in well (C-34-5)8adb-2 and in most other wells in the upper Sevier area (fig. 23).

PAVANT VALLEY

by D. B. Adams

The withdrawal from wells in Pavant Valley in 1970 was 70,600 acre-feet, 4,800 acre-feet less than that reported for 1969 (Sumsion and others, 1970, p. 17). Pumpage for irrigation in 1970 was less than that reported in 1969 because more surface water was available for irrigation.

Water levels rose from March 1970 to March 1971 in about 40 percent of Pavant Valley (fig. 25) and declined in about 60 percent of the valley; there was an average net decline of water levels of 0.2 foot. In comparison, an average net rise of 0.8 foot was observed from March 1969 to March 1970.

The maximum observed rise from March 1970 to March 1971 was more than 4 feet in the Pavant district. The maximum observed decline was more than 2 feet in the McCornick and Greenwood districts and near the edge of the valley north of Meadow.

The maximum declines in water level were in areas where pumped irrigation wells are concentrated and where the amount of pumpage in 1970 was the same or increased compared to previous years. The maximum rises were in areas where there was less pumpage in 1970 compared to previous years, where irrigation wells are used principally to supplement irrigation supplies from streams, or where the amount of recharge was relatively large. The relation between water levels in selected observation wells and cumulative departure from normal precipitation at Fillmore is shown in figure 26.

Pumpage rates and the quantity of water applied to irrigated fields in Pavant Valley affect the chemical quality of the water withdrawn from wells (Handy, Mower, and Sandberg, 1970, p. D229-D230). The concentration of dissolved solids in water from selected wells in the valley is shown in figure 27. In the Kanosh district (fig. 25), where pumpage has decreased and recharge may have increased, the concentration of dissolved solids in water from the two observations decreased from 1969 to 1970; the concentration also decreased in water from the artesian observation well in the nearby Flowell district. Conversely, the concentration of dissolved solids in water from the observation well in the Greenwood district and the one in the water-table aquifer in the Flowell district increased from 1969 to 1970. Declines of the water table in the Greenwood district have continued for several years.

CEDAR CITY VALLEY

by G. W. Sandberg

The withdrawal of water from wells in Cedar City Valley in 1970 was about 31,400 acre-feet, or about 4,200 acre-feet more than was reported for 1969 (Sumsion and others, 1970, p. 18). More ground water was pumped for irrigation because of decreased surface-water supplies available from Coal Creek. Water pumped for industry (mining) increased but water pumped for other uses remained the same as for 1969.

Water levels declined in nearly all the valley from March 1970 to March 1971 (fig. 28). The greatest declines were northwest of Cedar City where water levels are directly influenced by flow in Coal Creek which was below average in 1970.

The relations among water-level fluctuations in well (C-35-11) 33aac-1, cumulative departure from normal precipitation near Cedar City, annual discharge of Coal Creek, and annual pumpage for irrigation in the valley are shown in figure 29. Water levels declined as a result of decreased flow in Coal Creek and increased pumping. Heavy local rains during July-September and November increased the total annual precipitation recorded at Cedar City but did not significantly increase the flow in Coal Creek or cause a decrease in the amount of water pumped for irrigation.

PAROWAN VALLEY

by G. W. Sandberg

The withdrawal from wells in Parowan Valley was about 25,600 acre-feet in 1970, or 5,300 acre-feet more than was reported for 1969 (Sumsion and others, 1970, p. 19). The increase was entirely pumpage for irrigation and was the result of adding four new irrigation wells in 1970 (table 2).

Water levels declined in most of the irrigated area of the valley from March 1970 to March 1971 (fig. 30), because of increased pumpage. The maximum decline was more than 4 feet in the area immediately west of Parowan. Water levels rose only in a small area north of Summit and in the northern part of the valley.

The long-term relation among changes in water levels, precipitation, and pumpage for irrigation is illustrated in figure 31. The water-level decline from March 1970 to March 1971 in well (C-34-8) 5bca-1 resulted from increased pumpage in 1970. Although precipitation at Parowan in 1970 was above normal, some of it was from heavy local summer rains that did not significantly add to the streamflow available for irrigation or decrease pumping for irrigation.

ESCALANTE VALLEY

by R. W. Mower

Milford district

Withdrawal from wells in the Milford district in 1970 was 56,600 acre-feet, or 5,900 acre-feet more than reported for 1969 (Sumsion and others, 1970, p. 19). Most of this additional water in 1970 was for irrigation.

Water levels declined in most of the district because of increased pumpage, but generally rose in the southeast part of the district from March 1970 to March 1971 (fig. 32). The rise in the southeast part of the district was caused by recharge of irrigation water supplied by streamflow from the Beaver River, even though this part received about 40 percent less water from the river during 1970 than during 1969. Except for 1969, however, streamflow used for irrigation in 1970 was greater than during any year since 1958 with the result that recharge to the ground-water reservoir in most of the southeast part was greater during 1970 than the average annual recharge since 1958.

The relations among water levels in well (C-29-10)6ddc-2, precipitation at Milford airport, discharge of the Beaver River, and pumpage for irrigation are shown in figure 33. Pumpage for irrigation in the Milford district in 1970 was the highest of record and precipitation at Milford was below normal in 1970, resulting in a general decline of water levels. The general decline of water levels caused mainly by the increased pumpage is represented by the water-level decline in well (C-29-10)6ddc-2 near the middle of the pumped area.

Beryl-Enterprise district

by G. W. Sandberg

The withdrawal from wells in the Beryl-Enterprise district in 1970 was about 70,000 acre-feet, a decrease of 14,000 acre-feet compared to the amount reported for 1969 (Sumsion and others, 1970, p. 20). The decrease was due mainly to cessation of industrial pumpage; mine dewatering in sec. 2, T. 36 S., R. 17 W. was discontinued in 1970. Pumpage for irrigation decreased in 1970 by 1,400 acre-feet, and that for public supply, domestic, and stock uses remained the same as in 1969.

Water levels declined in most of the district from March 1970 to March 1971 (fig. 34). The maximum decline was more than 3 feet in a small area west and north of Enterprise. The general decline in the district resulted from pumpage which caused discharge to exceed recharge to the ground-water reservoir in the heavily pumped area.

Water levels rose from March 1970 to March 1971 in three areas: northeast of Enterprise, in the west-central part of the district, and in the Beryl area. The rise northeast of Enterprise is probably the residual effect of recharge from Shoal Creek, which caused large rises in water level at Enterprise during 1969 (Sumsion and others, 1970, fig. 34). The rises in the west-central part of the district are due partly to increased recharge from runoff in the adjacent hills, partly to the residual effect of seepage from the canal that conveyed mine drainage from the well in sec. 2, T. 36 S., R. 17 W. to lands in the irrigated part of the district, and partly to recovery of water levels after the pumping for dewatering had ceased. The rise in the Beryl area probably is due to recharge from precipitation exceeding discharge in an area where ground-water withdrawals are small.

The long-term relation among water levels, precipitation, and pumpage for irrigation is shown in figure 35. The graphs show that the water level in the well has declined steadily in response to increasing pumpage for irrigation; most of the decline occurred during a period of below-normal precipitation. During 1967-70, precipitation was above normal; the rate of water-level decline in well (C-35-17) 25dcd-1 diminished mainly because pumpage for irrigation nearly stabilized, and in 1970, the water level rose because local recharge exceeded discharge.

The concentration of dissolved solids in ground water in the Beryl-Enterprise district increased as a result of water-level declines caused by pumping for irrigation (Handy, Mower, and Sandberg, 1969, p. D232). Water levels were lowered to the extent that in 1964 a permanent depression in the water table developed (Arnow and others, 1965, p. 91); return seepage from irrigation no longer flows out of the district but is recycled to the fields. The increase in the concentration of dissolved solids in water from three wells in the district is shown in figure 36, and the locations of the wells are shown in figure 34. The concentration increased at all wells during 1970; the greatest overall increase has been recorded at well (C-36-16)5a-9, which is closest to the center of the depression in the water table.

OTHER AREAS

by R. G. Butler

Total withdrawal from wells in other parts of Utah during 1970 is not known, but is estimated to be 71,900 acre-feet. This amount is 15,900 acre-feet more than that reported for 1969 (Sumsion and others, 1970, p. 21), and the increase is due partly to the inclusion of a more accurate figure for withdrawal from wells in Washington County and partly to the increase in the number of large-diameter wells used in 1970.

Water levels rose as a result of above-normal precipitation in the Heber, Snake, Upper Bear River, Grouse Creek, Curlew, and Cedar Valleys, and in the Dugway area (fig. 37). A different observation well is shown for Curlew Valley for 1970 than for previous years.

Water levels rose in the Blanding area, Uintah Basin, and in the south flank of the Uinta Mountains, although precipitation was below normal (fig. 37).

Water levels declined in Bear Lake, Beaver, Morgan, Ogden, Park, and Upper Fremont Valleys although precipitation in 1970 was above normal (fig. 37). The decline of water levels in Ogden Valley resulted from the decrease of load on the artesian aquifer caused by the draining of Pineview Reservoir.

Water levels declined in the Monticello and St. George areas, reflecting below-normal precipitation (fig. 37).

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Sumsion, C. T., and others, 1970, Ground-water conditions in Utah, spring of 1970: Utah Div. Water Resources Coop. Inv. Rept. 8, 71 p.

ILLUSTRATIONS

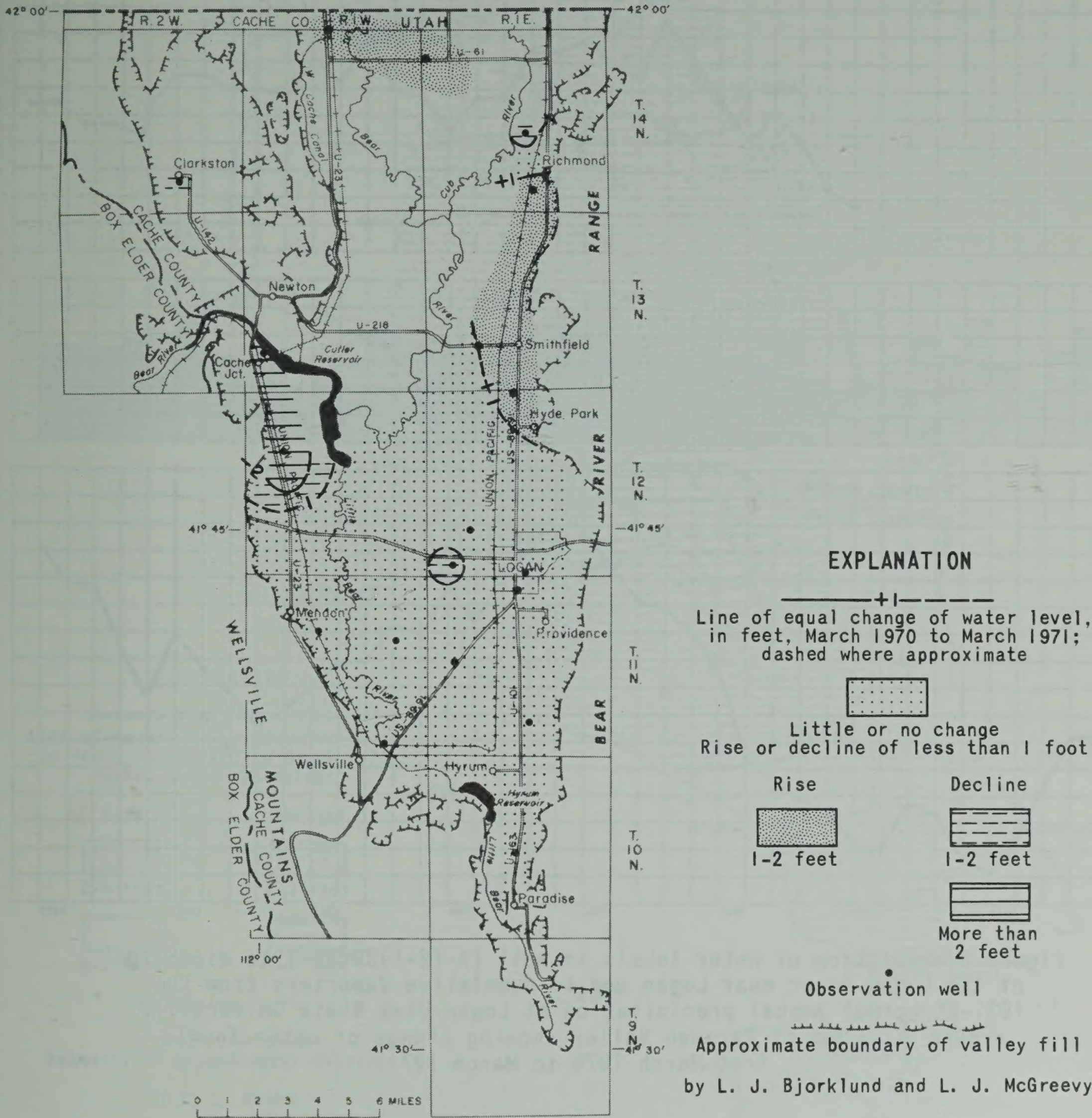


Figure 2.—Map of Cache Valley showing change of water levels from March 1970 to March 1971.

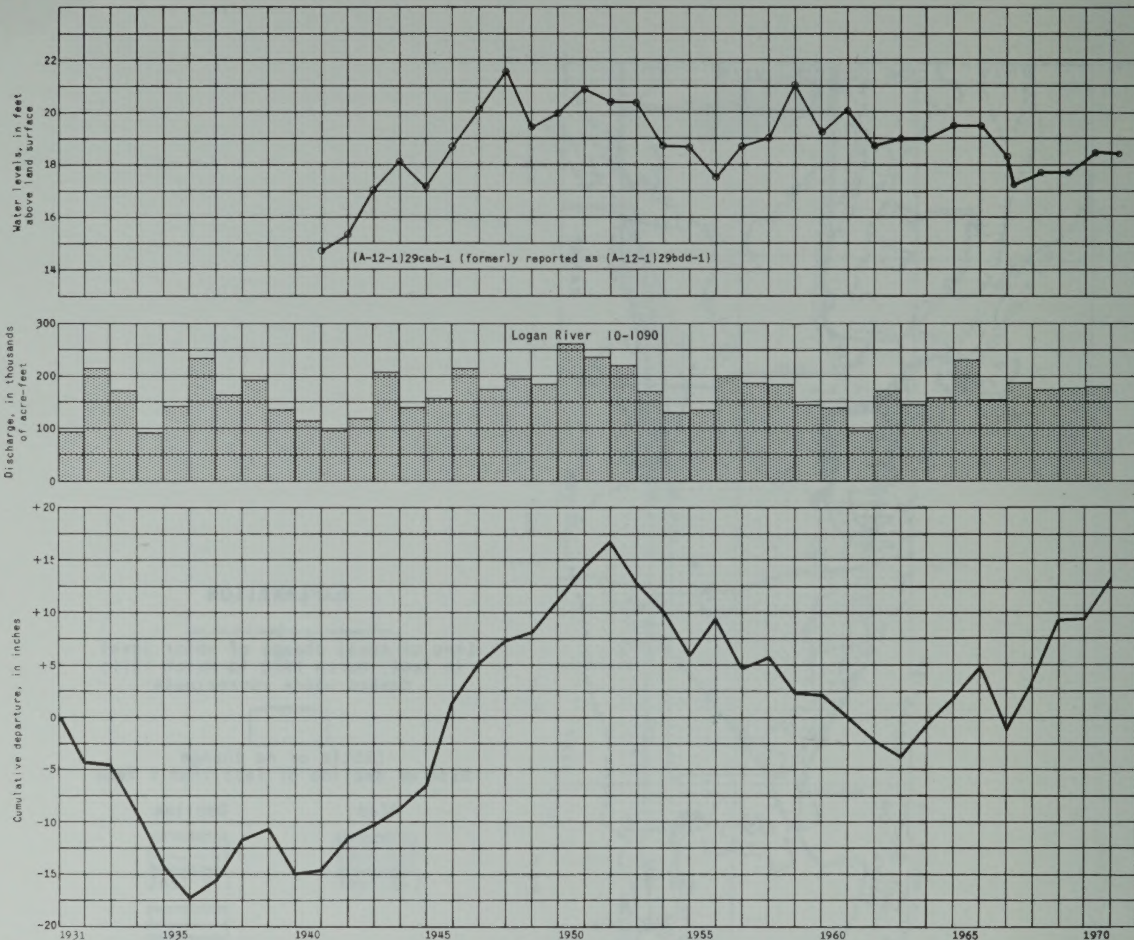


Figure 3.--Relation of water levels in well (A-12-1)29cab-1 to discharge of the Logan River near Logan and to cumulative departure from the 1931-60 normal annual precipitation at Logan Utah State University.

Figure 30.—Map of Parowan Valley showing change of water levels from March 1970 to March 1971.

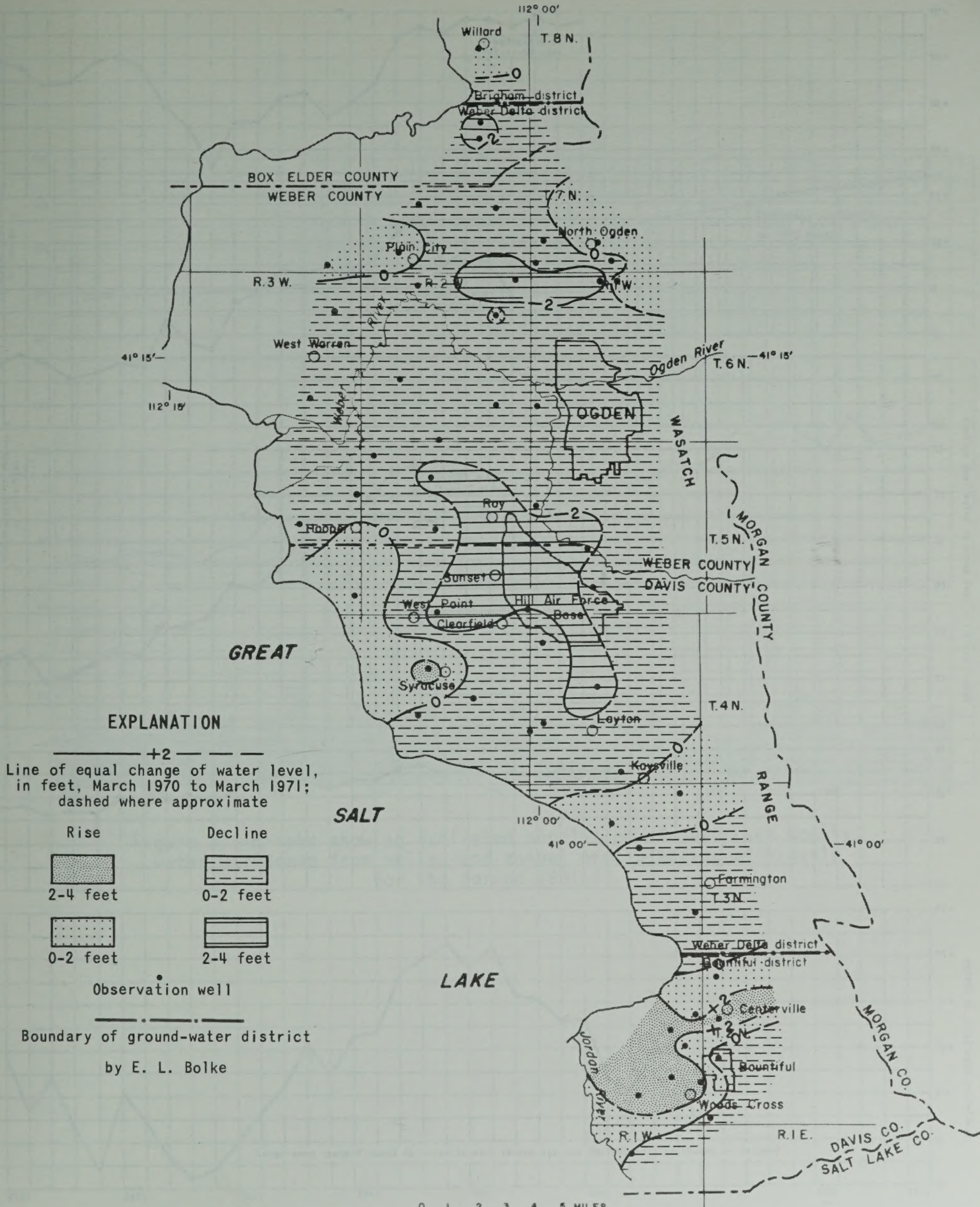


Figure 4.—Map of the East Shore area, Weber Delta and Bountiful districts, showing change of water levels from March 1970 to March 1971.

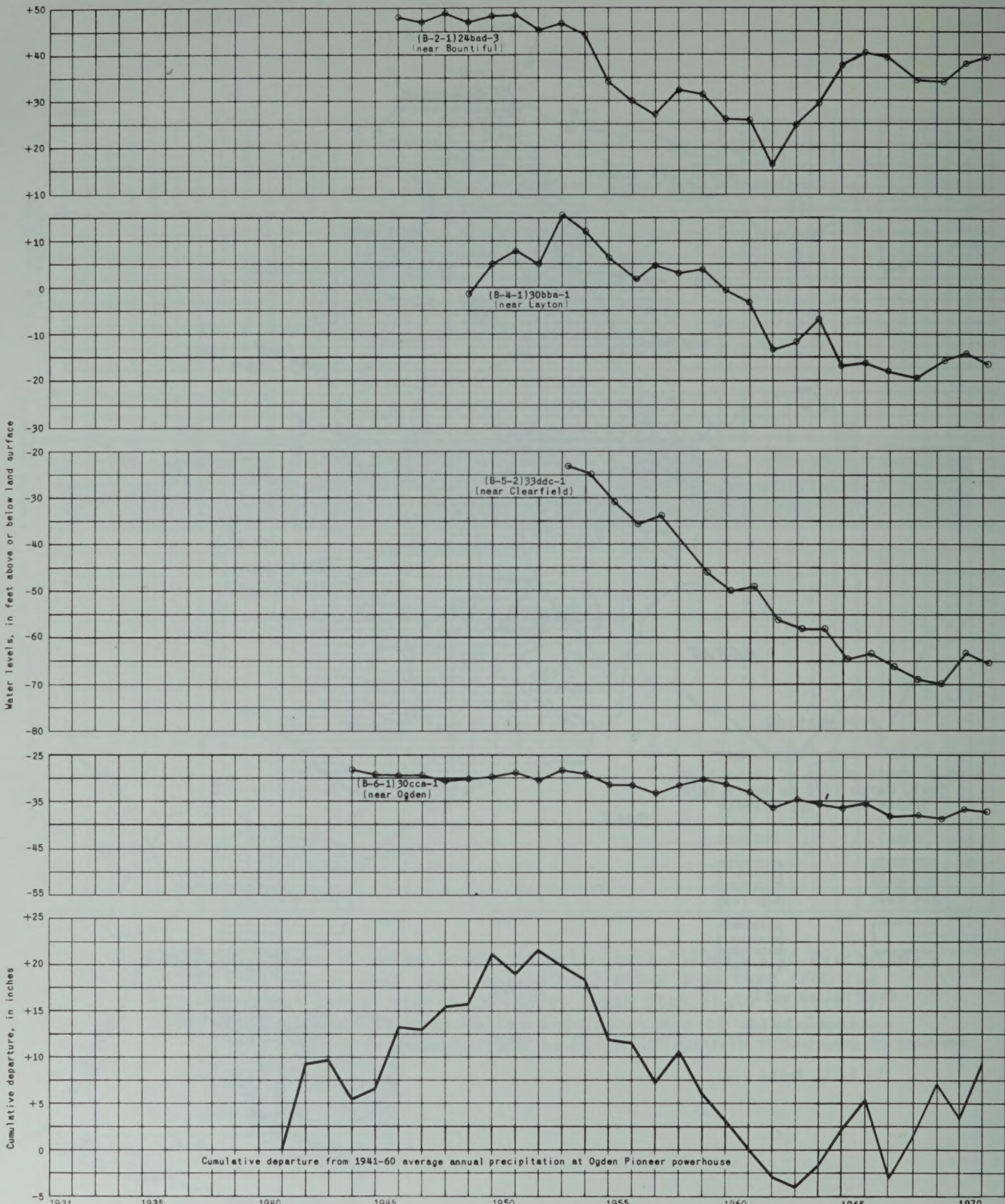


Figure 5.—Relation of water levels in wells near Bountiful, Layton. Clearfield, and Ogden to cumulative departure from the average annual precipitation at Ogden Pioneer powerhouse.

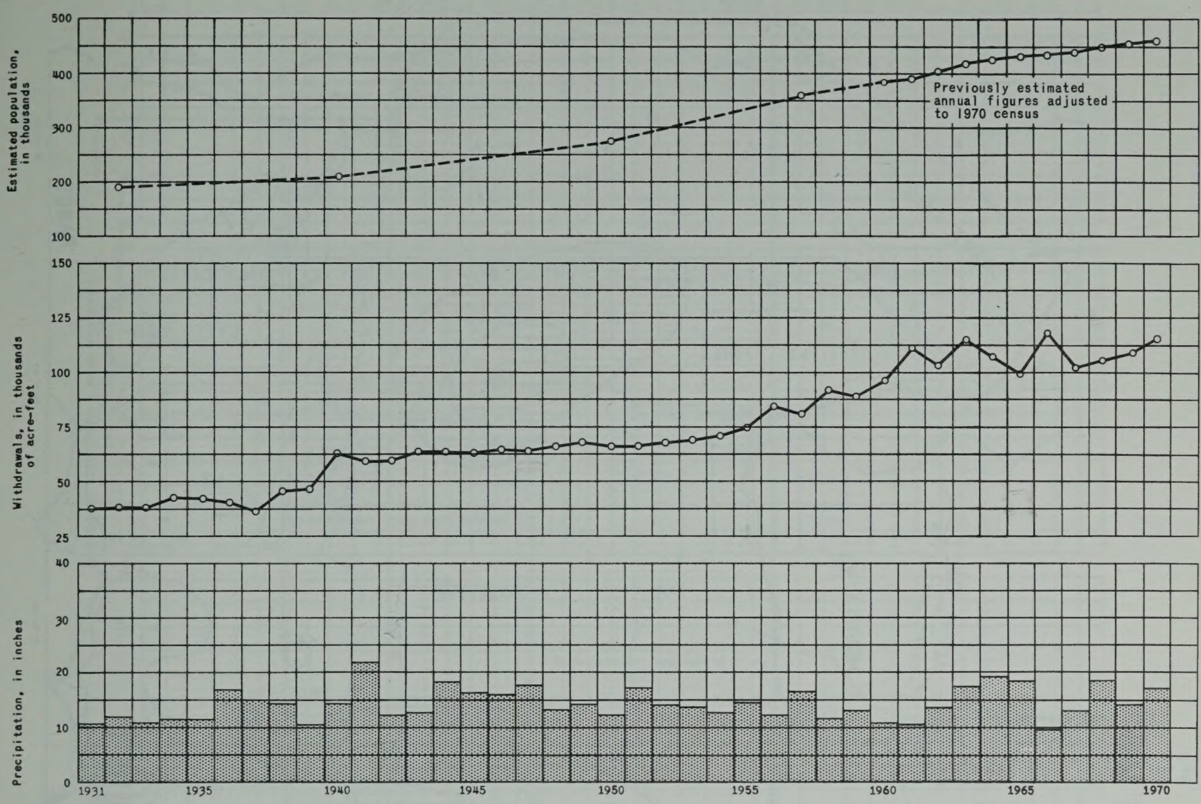


Figure 6.—Graphs showing estimated population of Salt Lake County, water withdrawn from wells, and annual precipitation at Midvale for the period 1931-70.

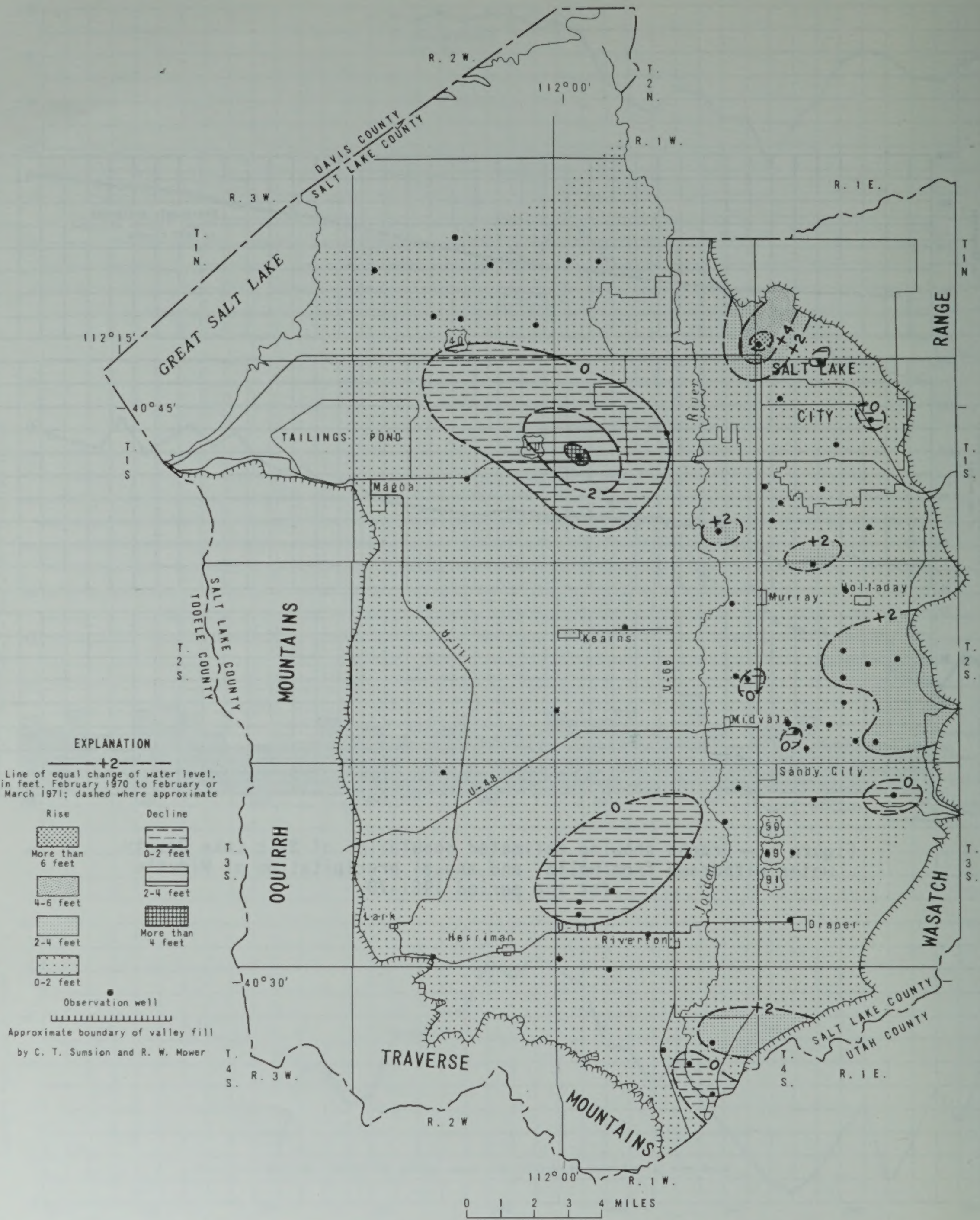


Figure 7.—Map of the Jordan Valley showing change of water levels from February 1970 to February or March 1971.

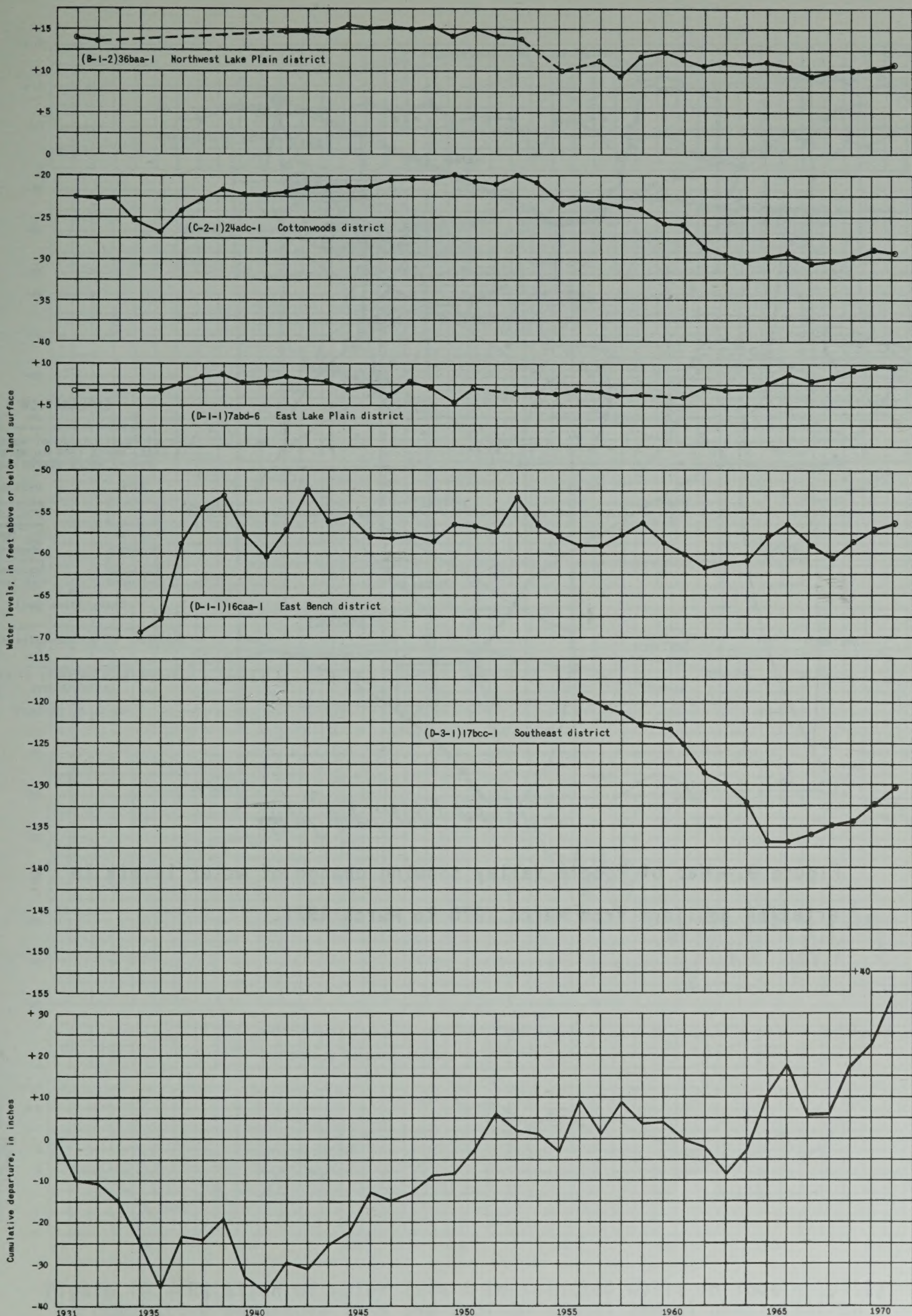


Figure 8.--Relation of water levels in selected wells in the Jordan Valley to cumulative departure from the 1931-60 normal annual precipitation at Silver Lake Brighton.

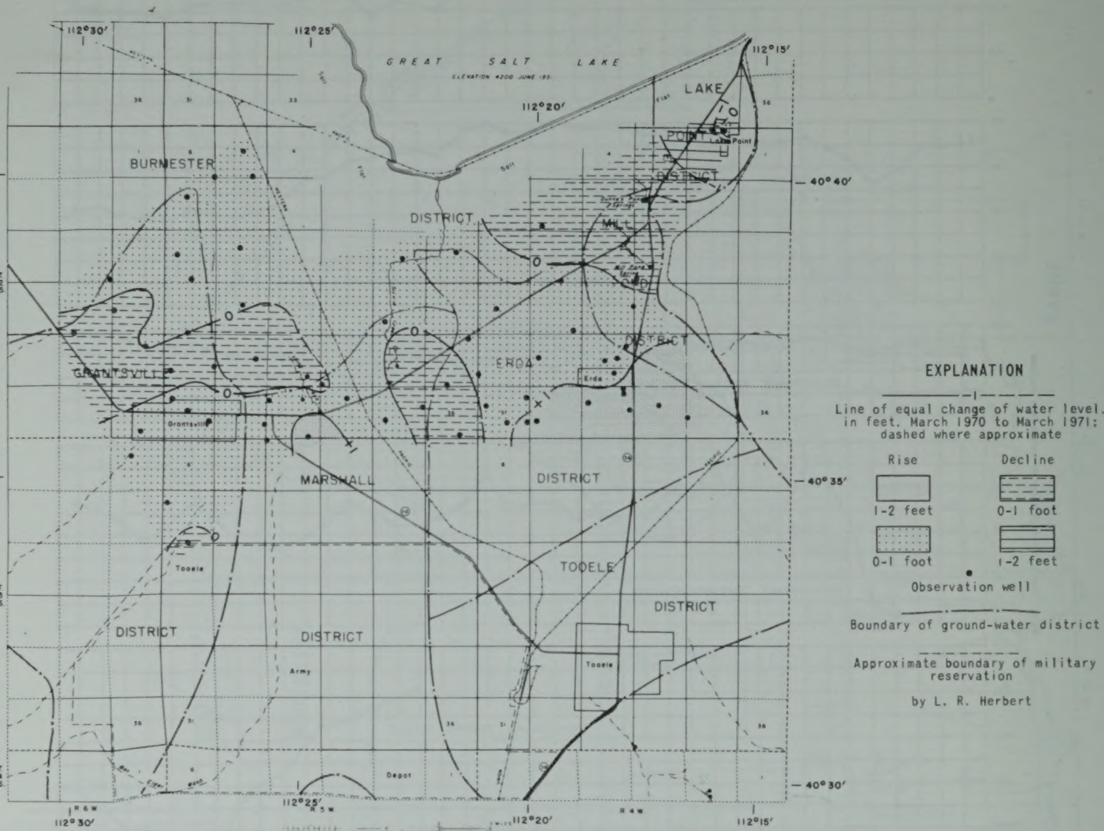


Figure 9.—Map of Tooele Valley showing change of water levels in artesian aquifers from March 1970 to March 1971.

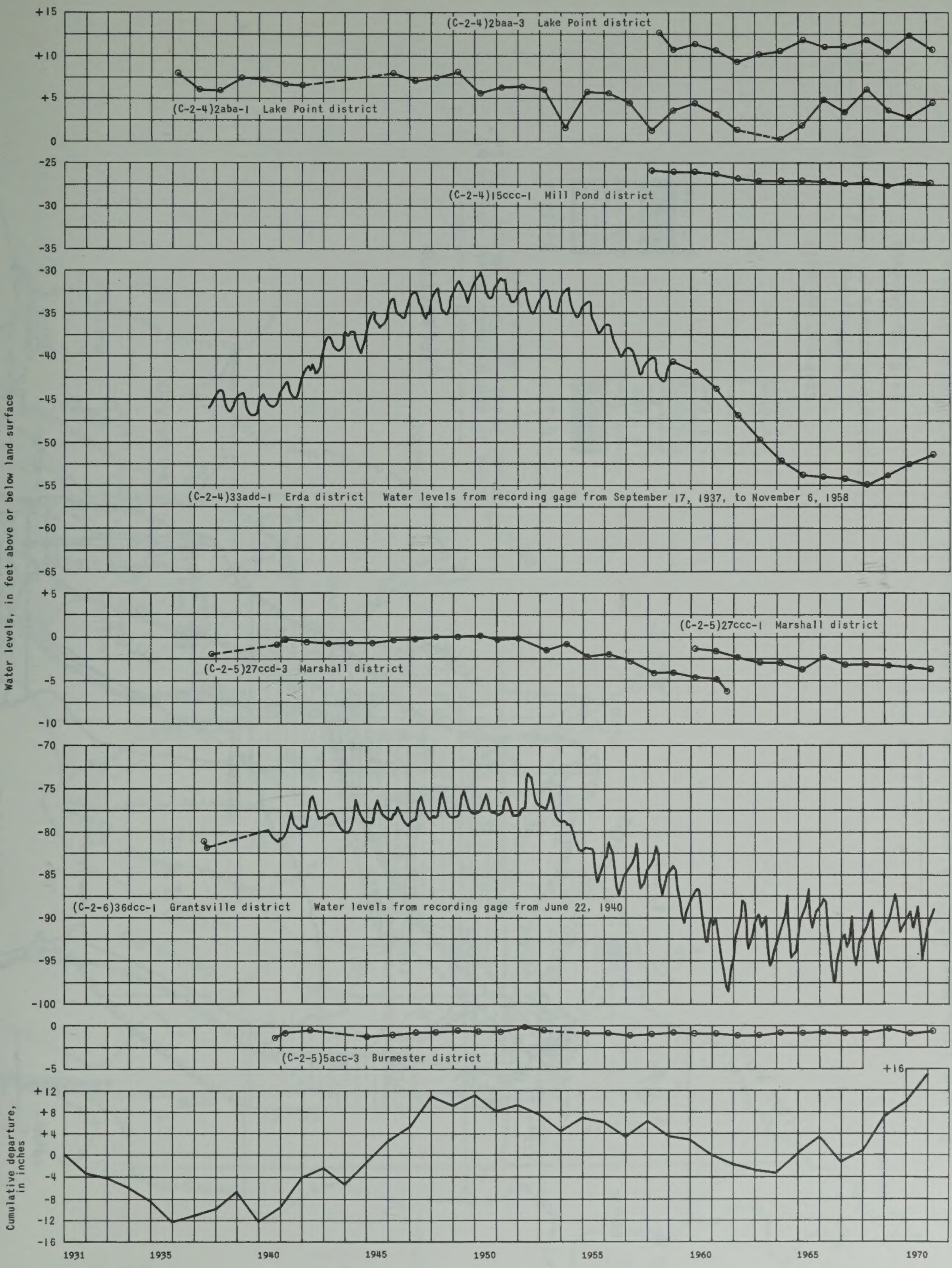
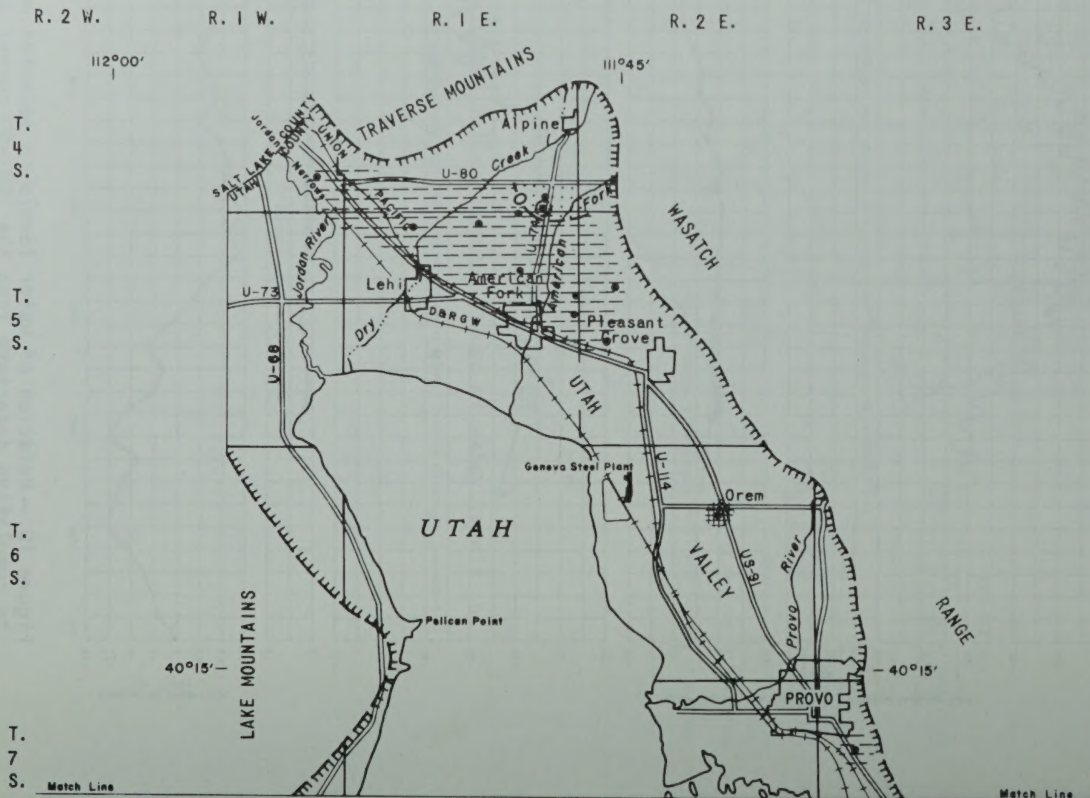


Figure 10.—Relation of water levels in selected wells in Tooele Valley to cumulative departure from the 1931-60 normal annual precipitation at Tooele.



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Creek
WASATCH
Jordan River
Lehi
American Fork
U-73
Dry
D&RGW
Pleasant Grove
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Geneva Steel Plant
U-114
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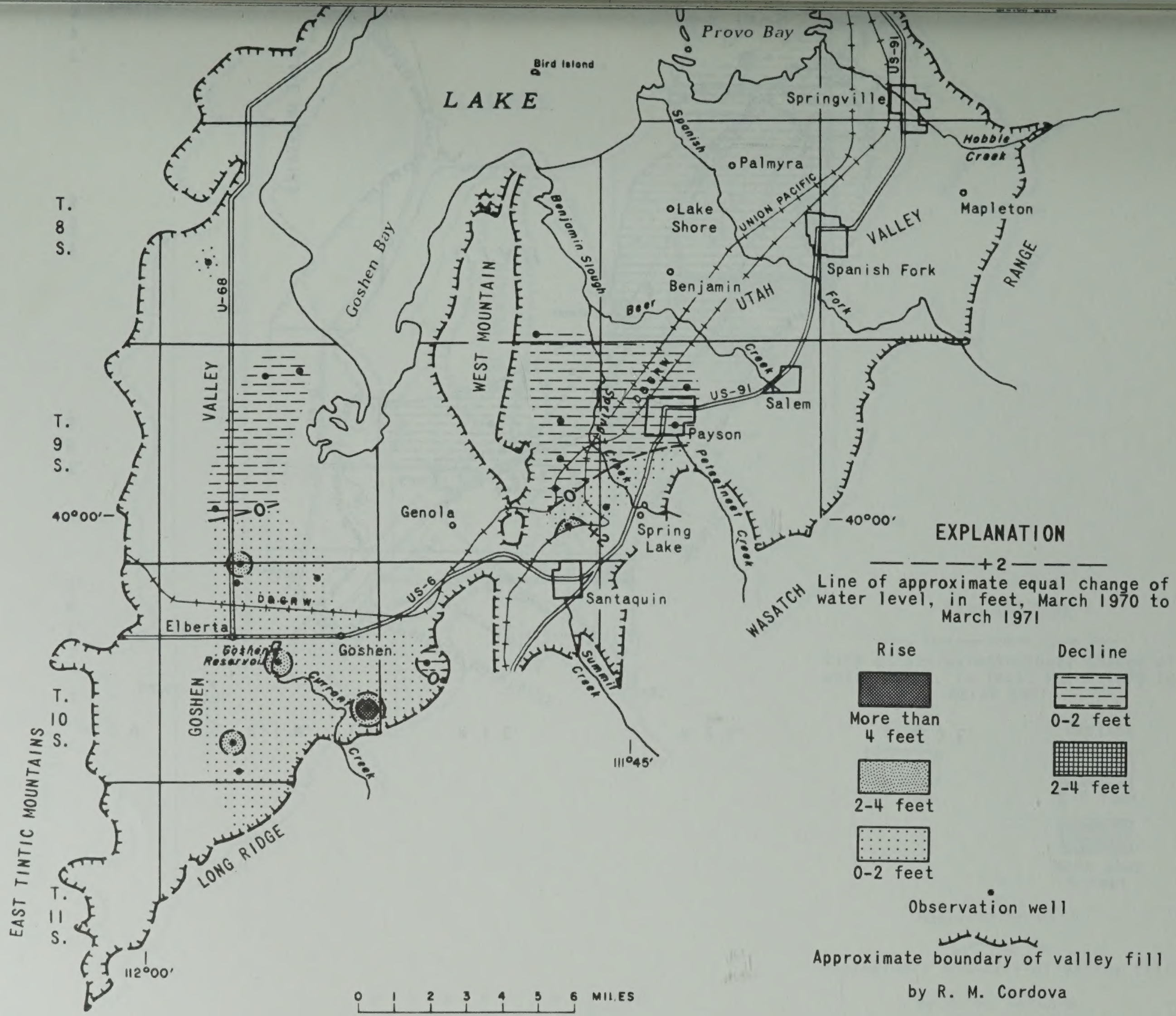
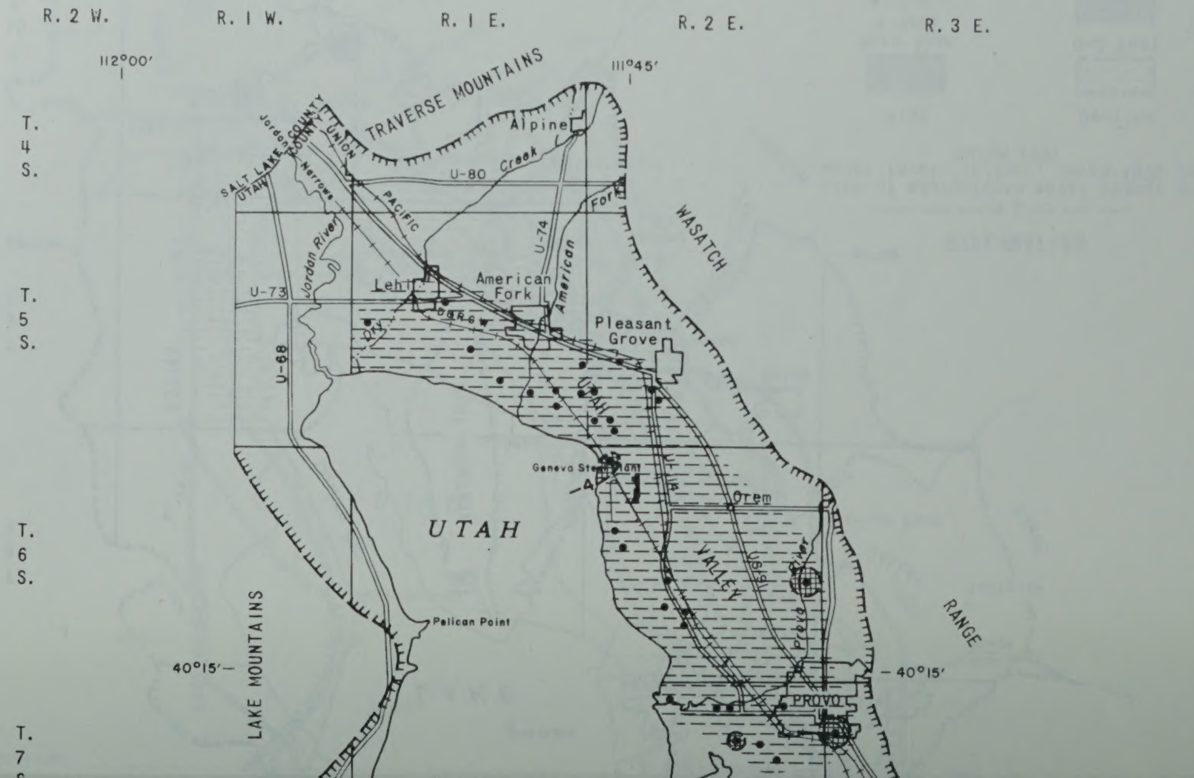


Figure 11.—Map of Utah and Goshen Valleys showing change of water levels in the water-table aquifers from March 1970 to March 1971.

- 36 -



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Lehi
American Fork
U-73
Pleasant Grove
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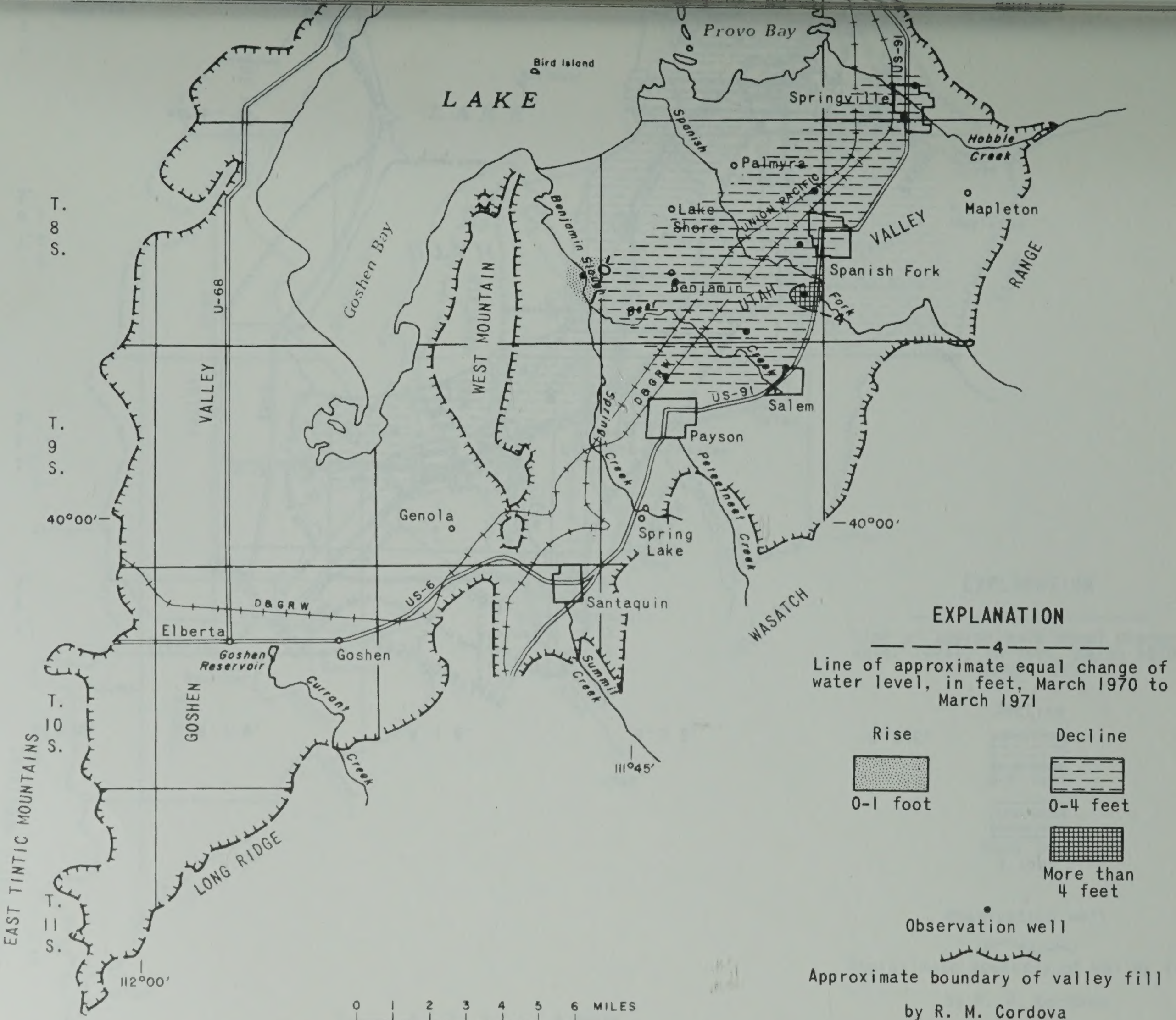
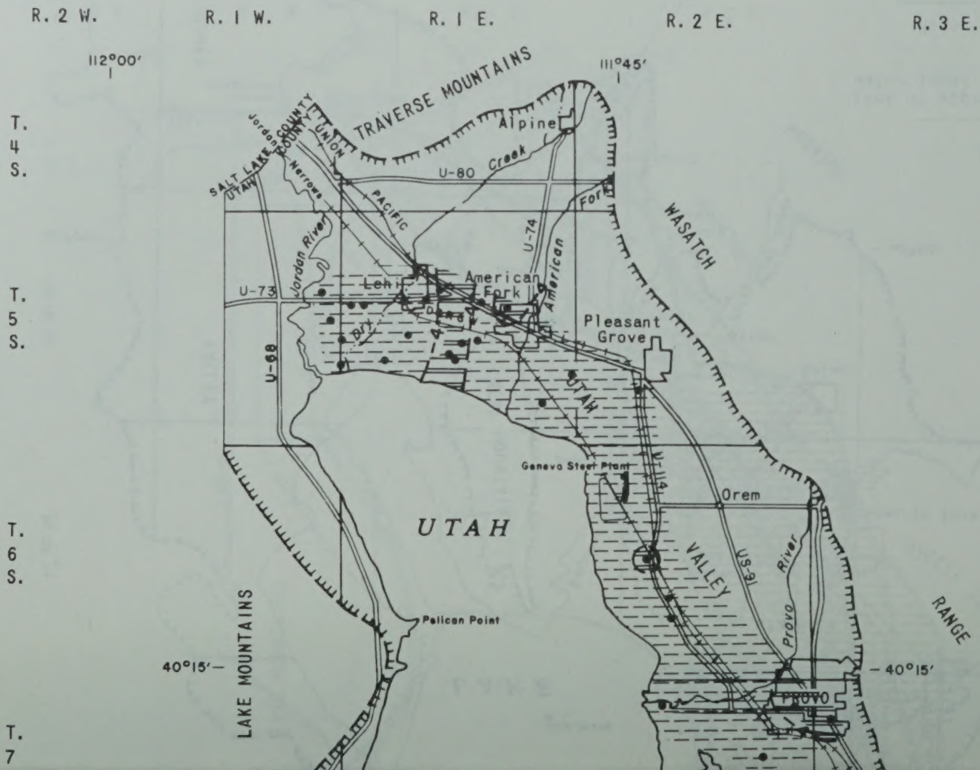


Figure 12.—Map of Utah and Goshen Valleys showing change of water levels in the shallow artesian aquifer in rocks of Pleistocene age from March 1970 to March 1971.



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Jordan River
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American Fork
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Pleasant Grove
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Geneva Steel Plant
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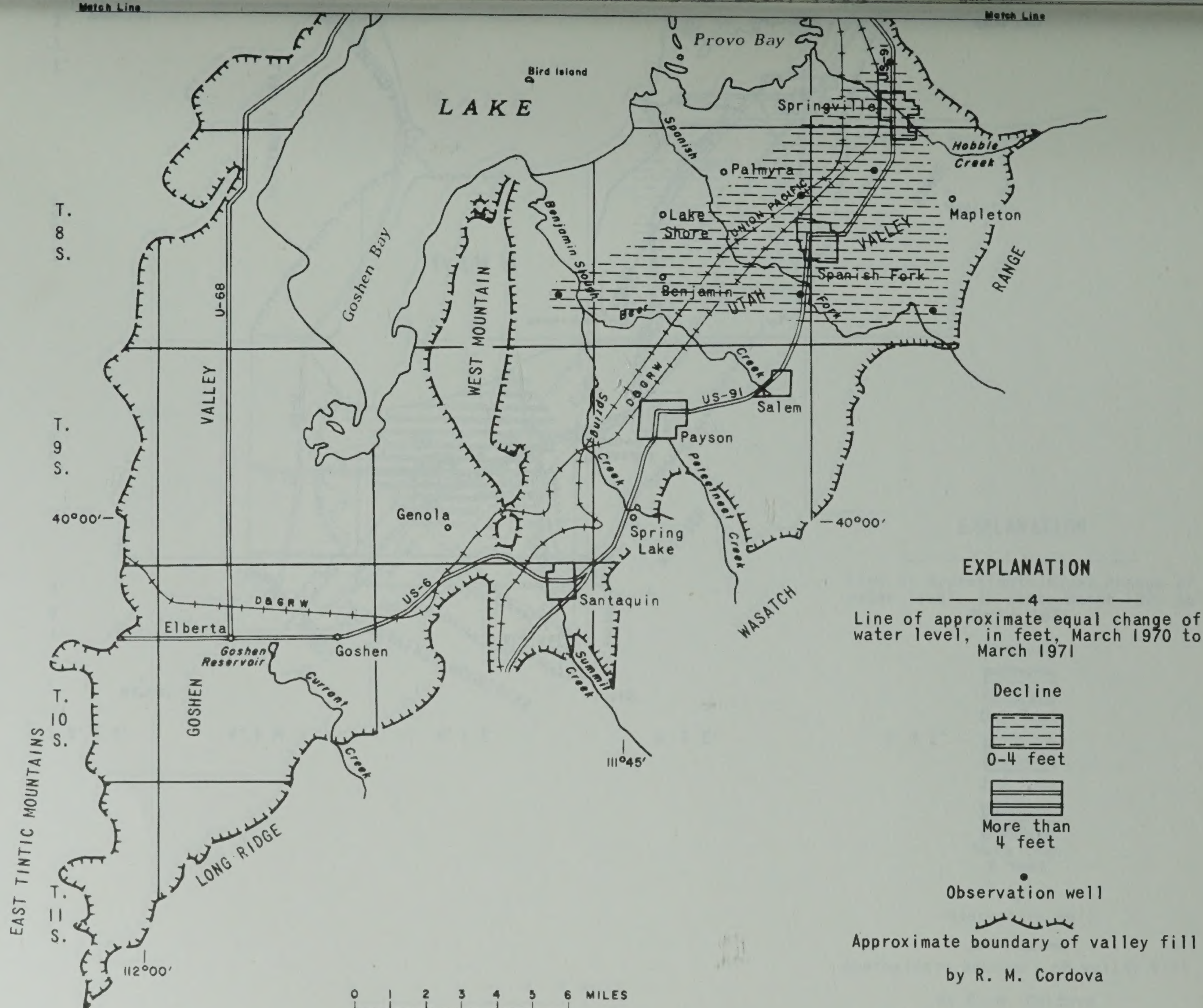
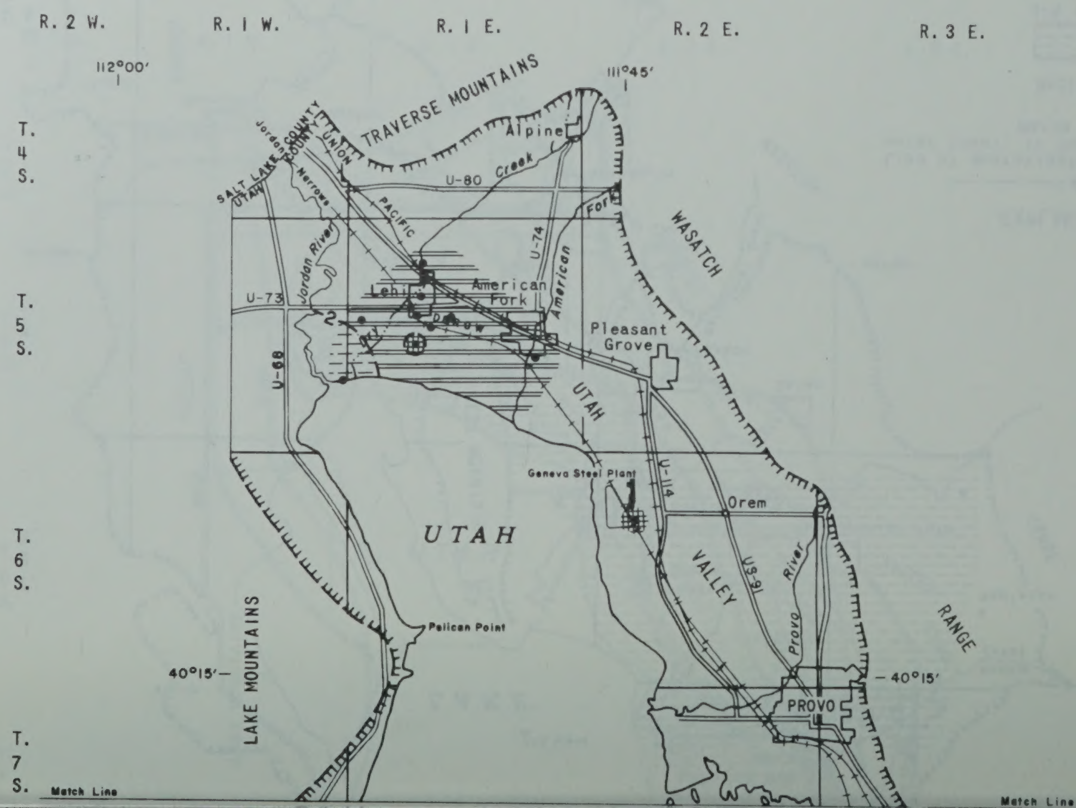


Figure 13.—Map of Utah and Goshen Valleys showing change of water levels in the deep artesian aquifer in rocks of Pleistocene age from March 1970 to March 1971.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Pleasant Grove
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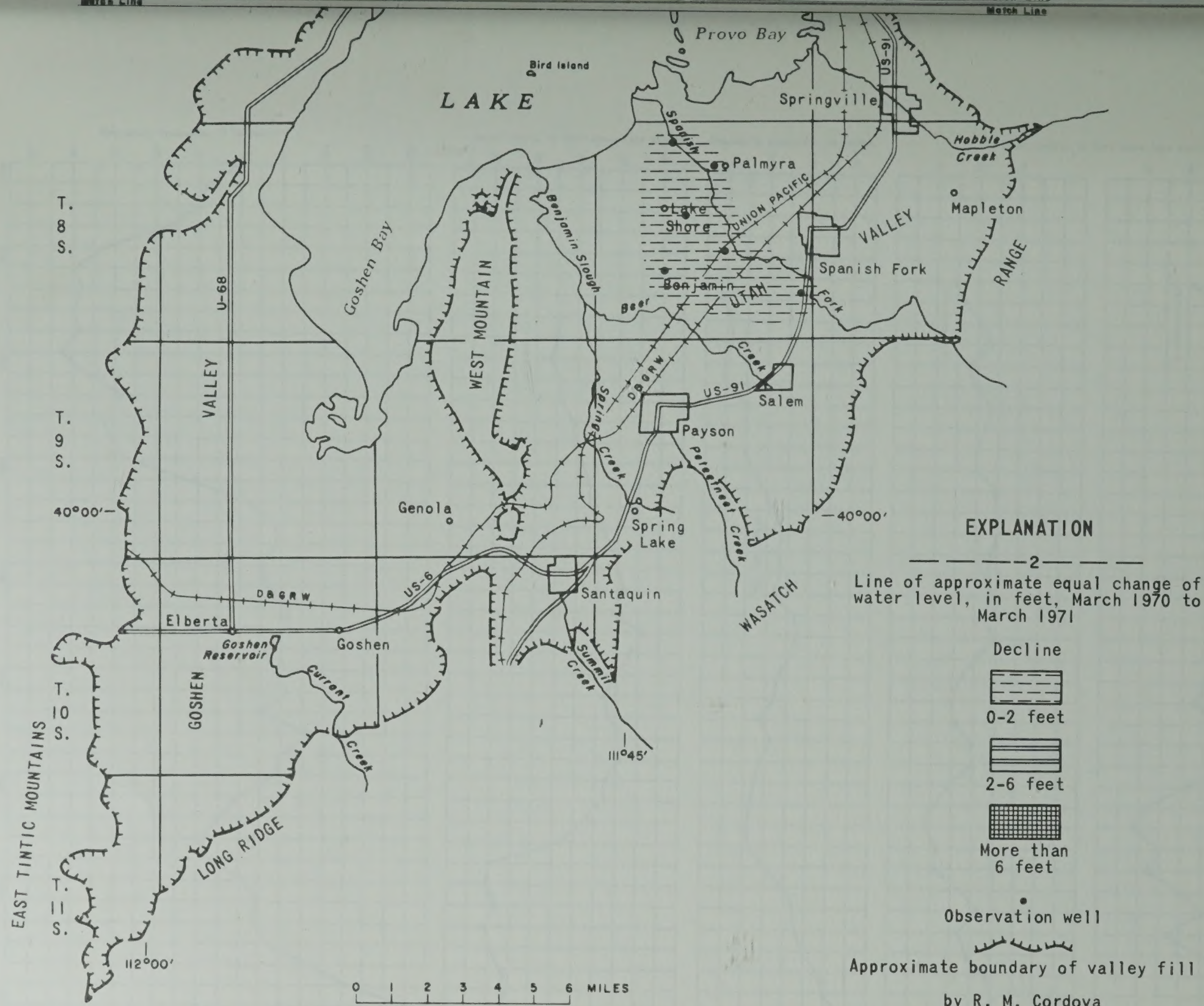


Figure 14.—Map of Utah and Goshen Valleys showing change of water levels in the artesian aquifer in rocks of Tertiary age from March 1970 to March 1971.

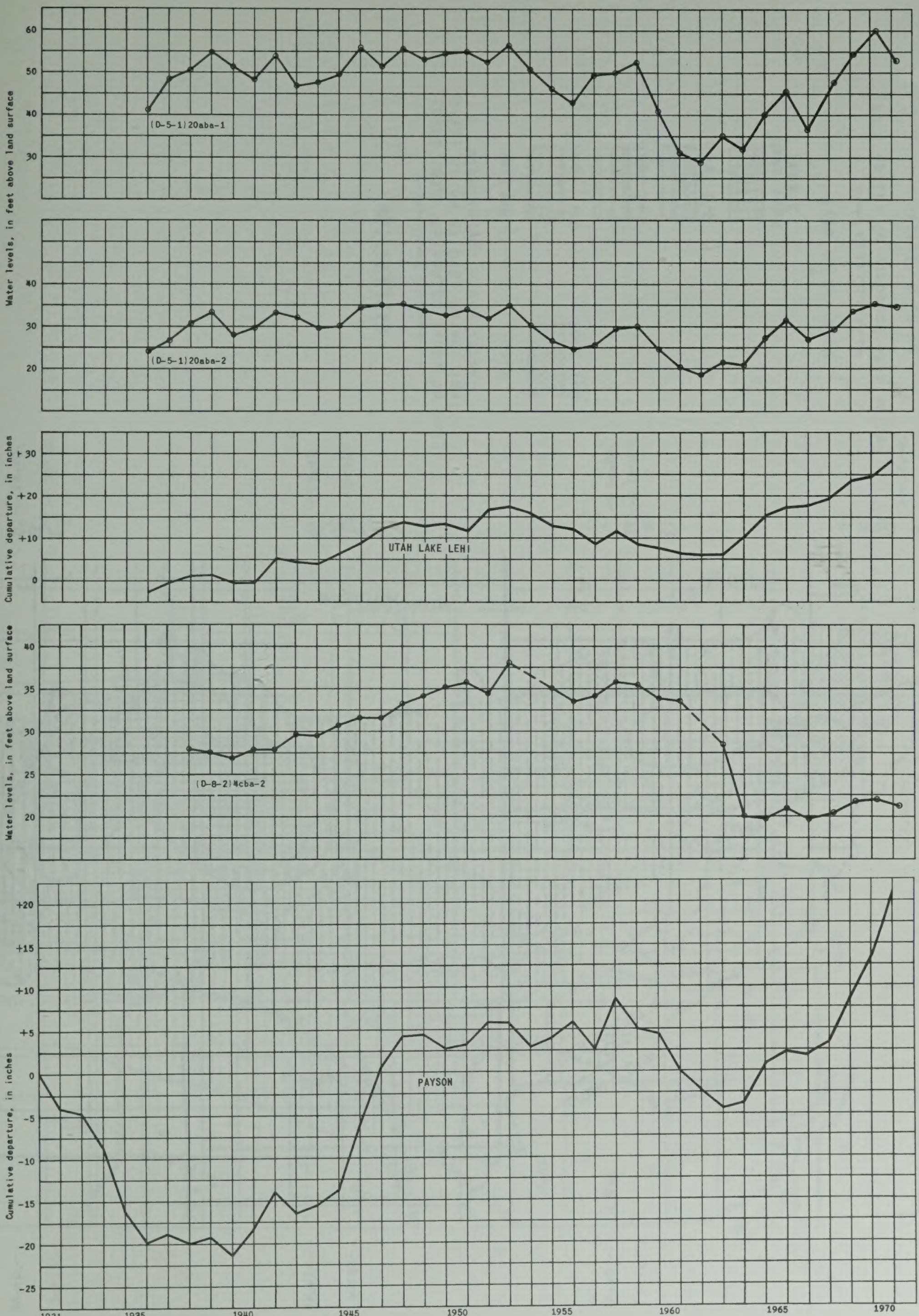
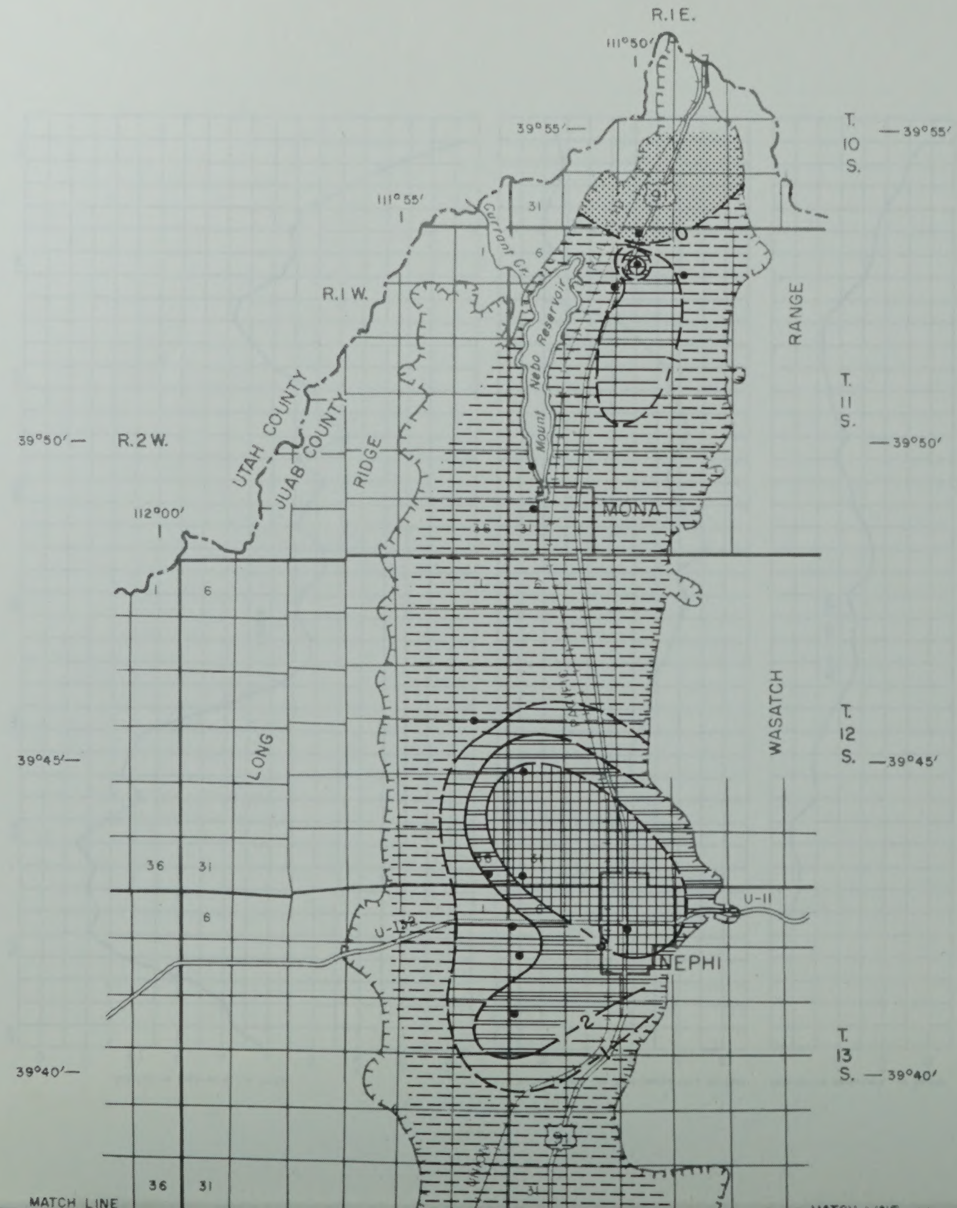


Figure 15.--Relation of water levels in selected observation wells in Utah Valley to cumulative departure from the 1931-60 normal annual precipitation at Utah Lake Lehi and Payson.



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UTAH COUNTY
JUAB COUNTY
RIDGE
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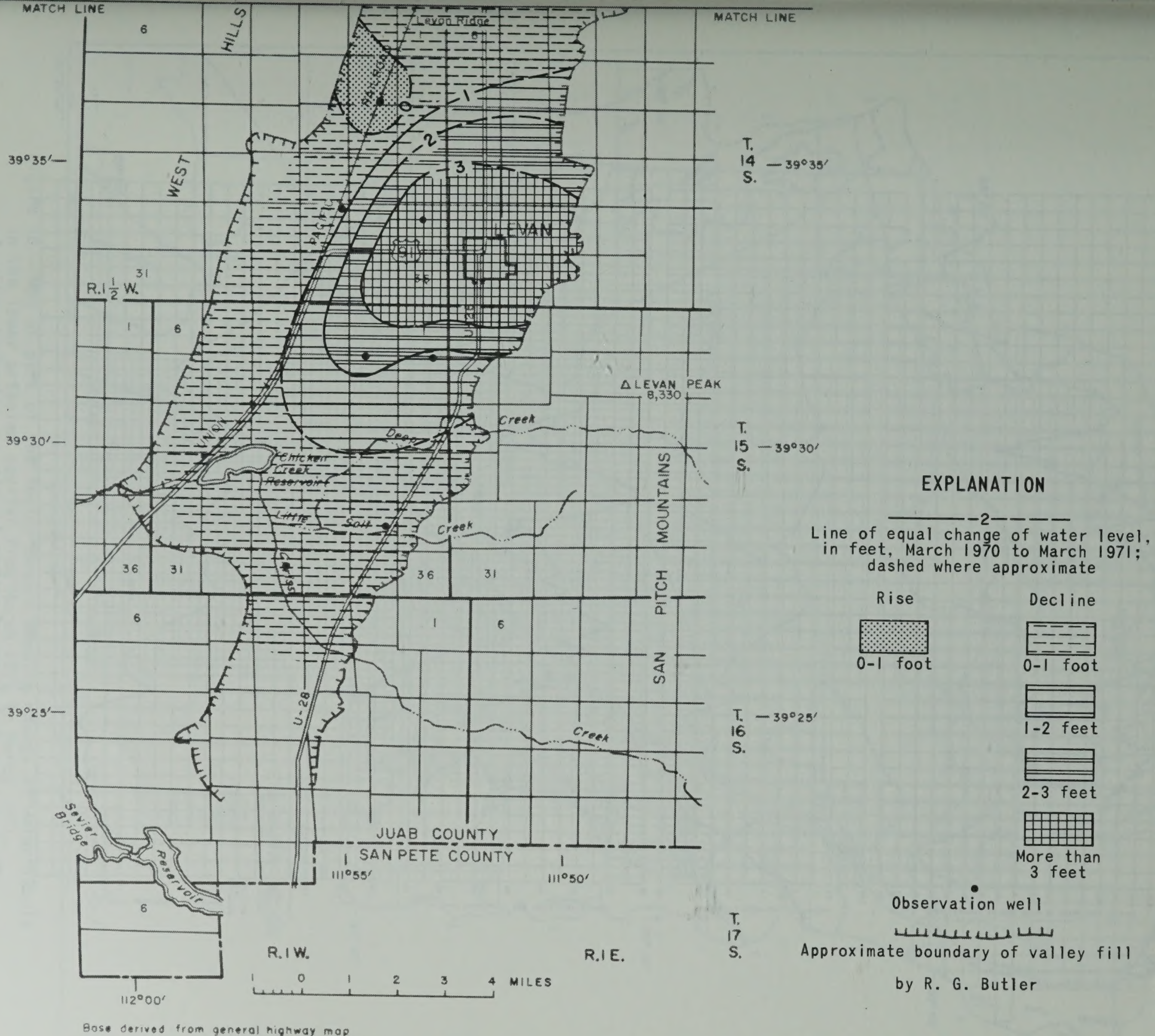


Figure 16.—Map of Juab Valley showing change of water levels from March 1970 to March 1971.

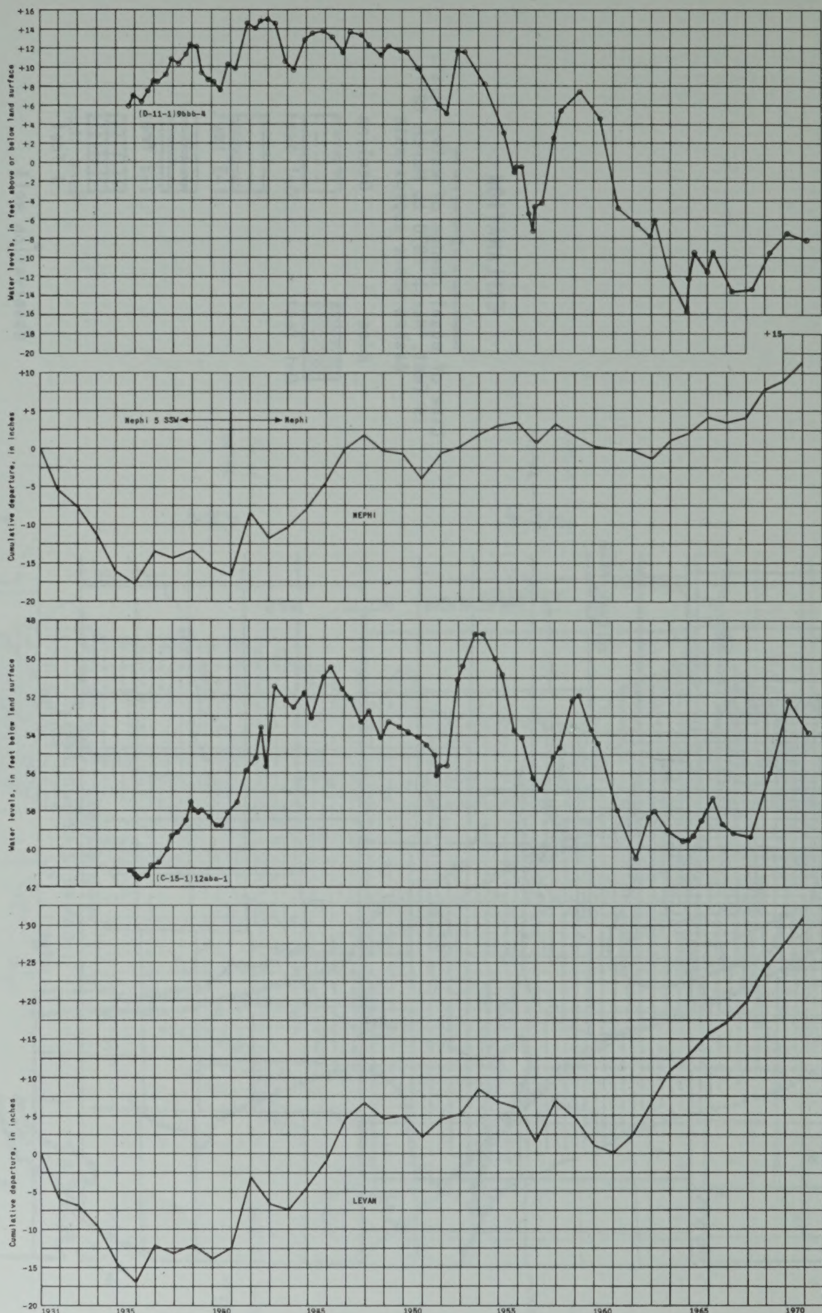


Figure 17.—Relation of water levels in selected wells to cumulative departure from the 1931-60 normal annual precipitation at Nephi and Levan.

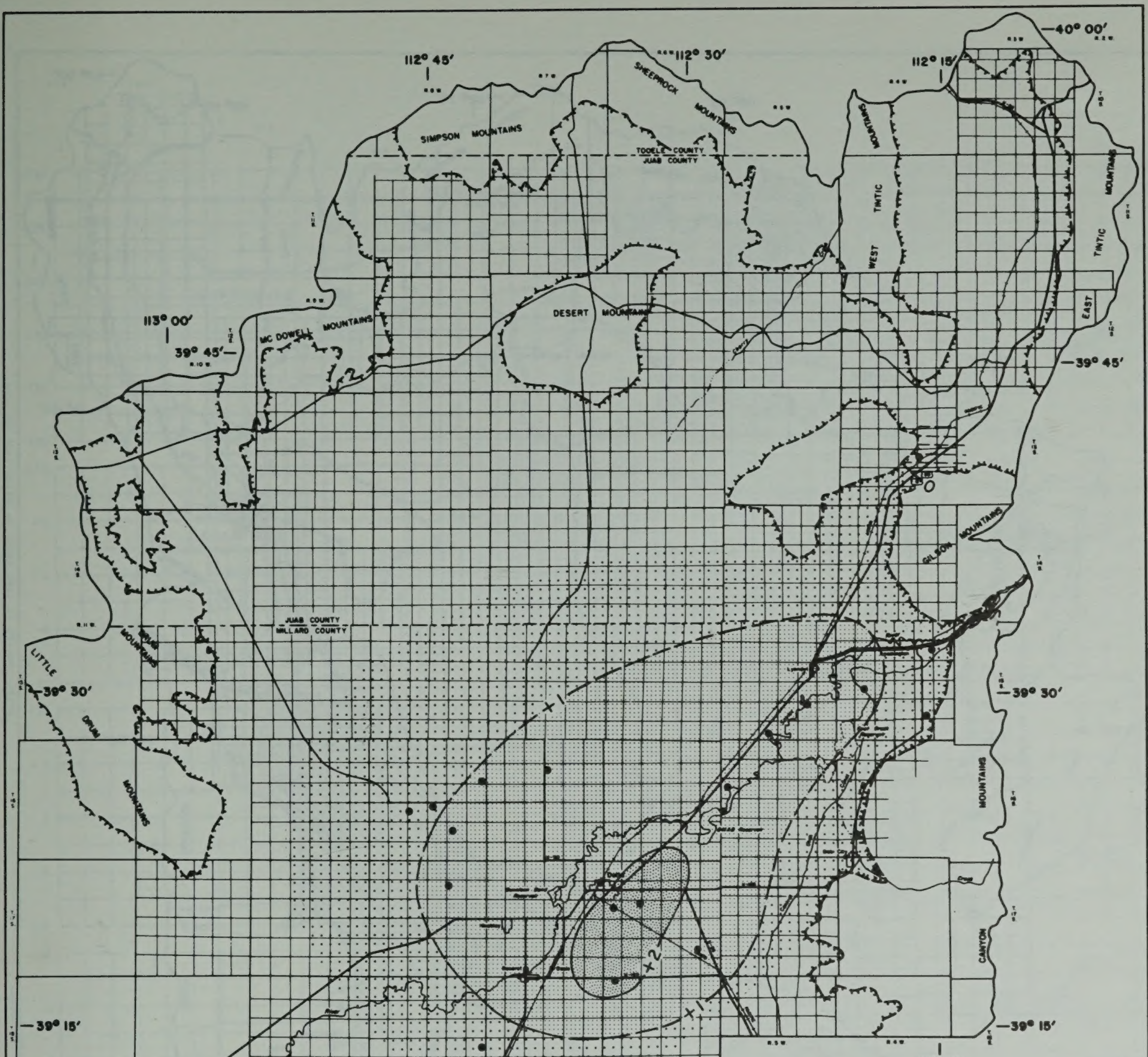


Figure 18.—Map of part of the Sevier Desert showing change of water levels in the lower artesian aquifer from March 1970 to March 1971.

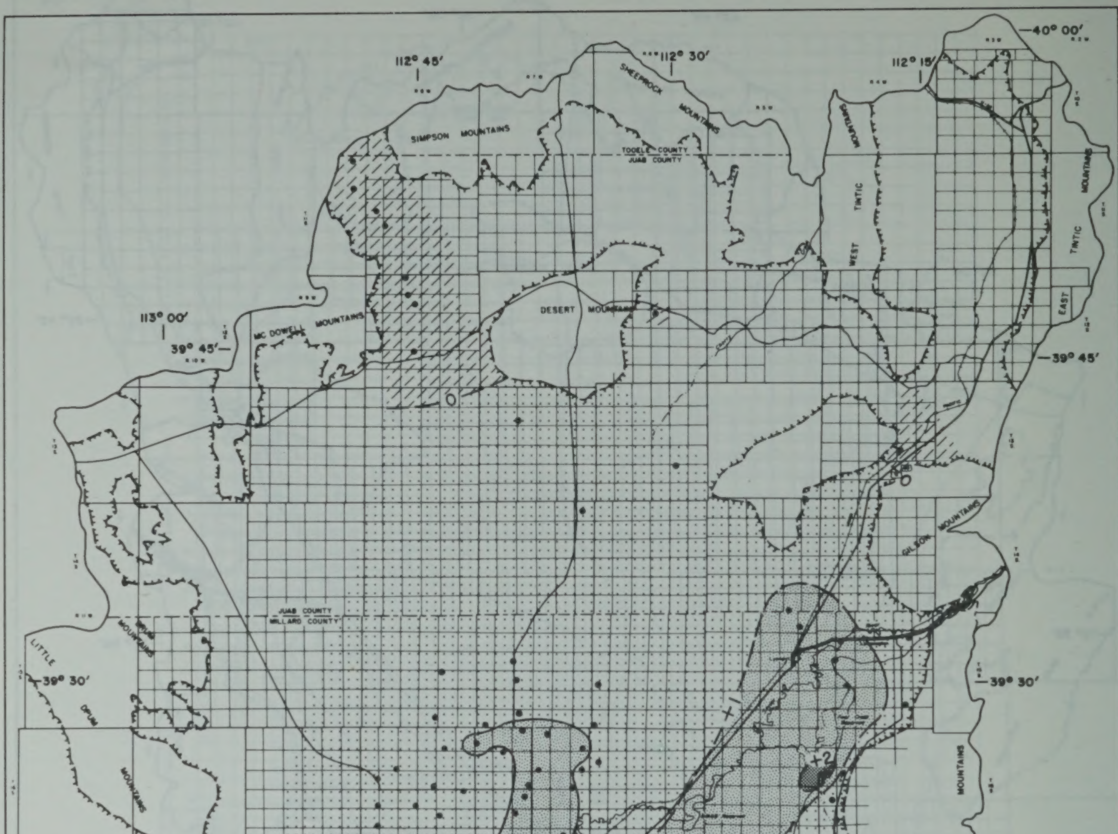


Figure 19.—Map of part of the Sevier Desert showing change of water levels in the upper artesian aquifer from March 1970 to March 1971.

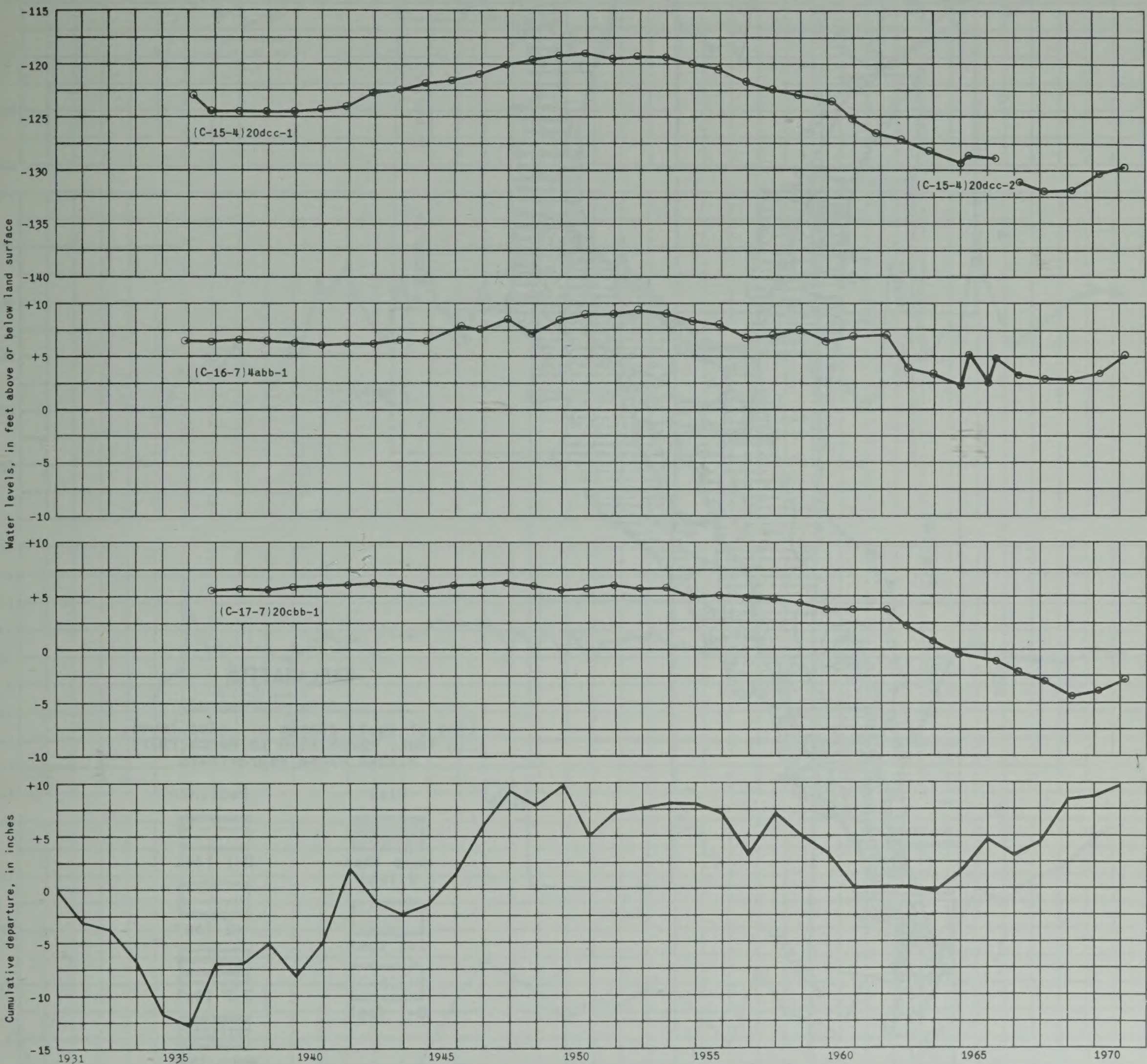


Figure 20.--Relation of water levels in selected wells in the Sevier Desert to cumulative departure from the 1931-60 normal annual precipitation at Oak City.

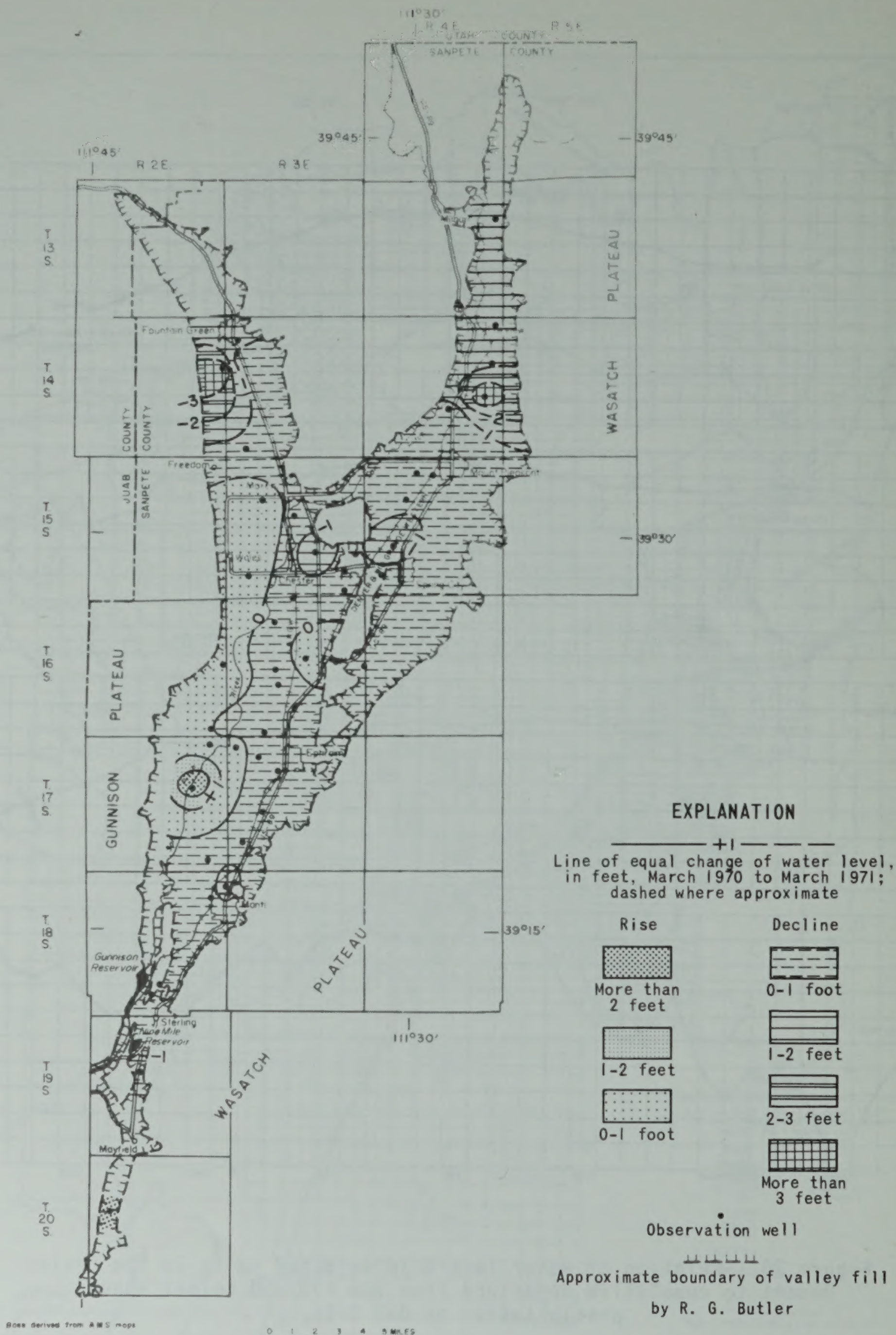


Figure 21.—Map of Sanpete Valley showing change of water levels from March 1970 to March 1971.

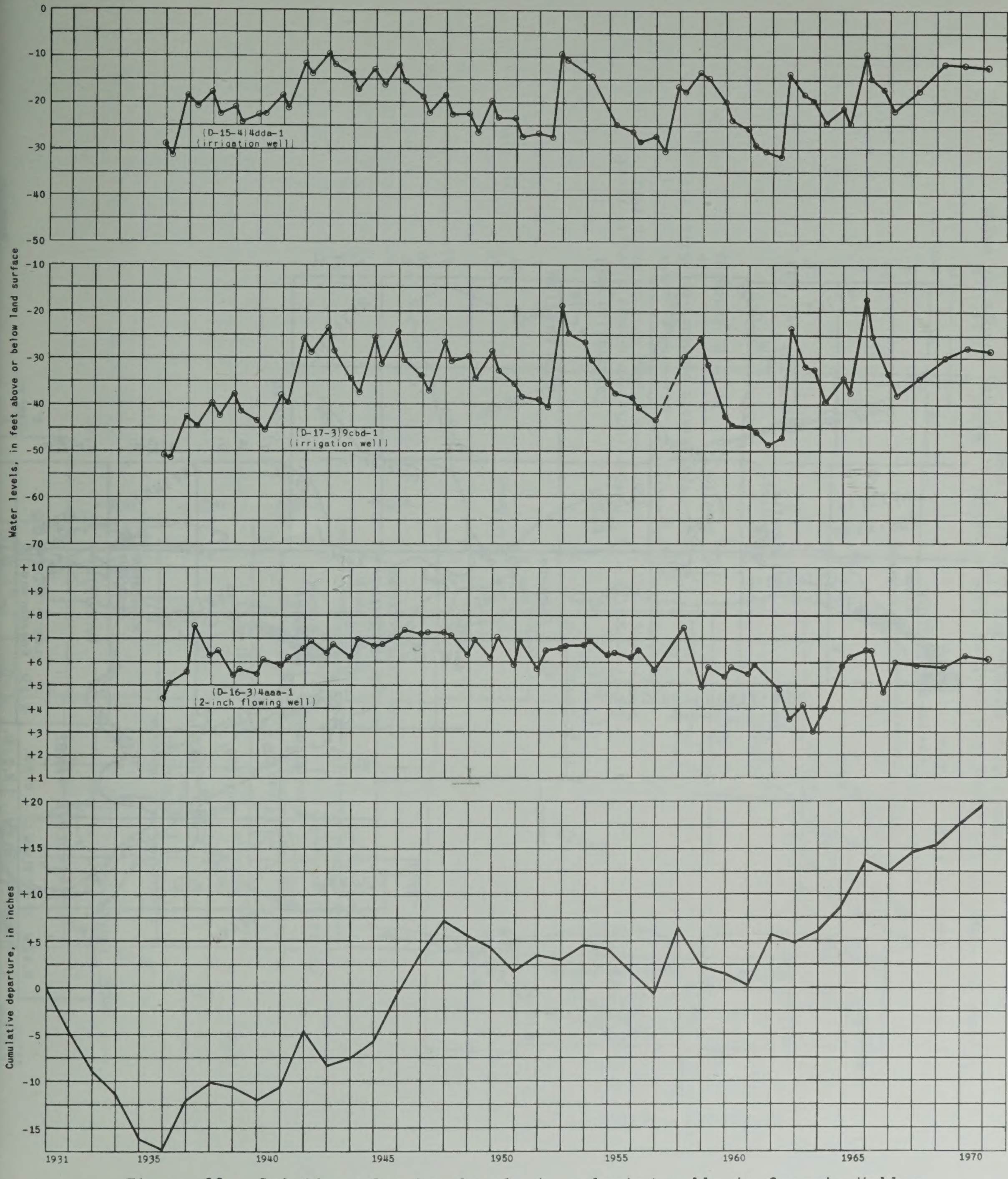
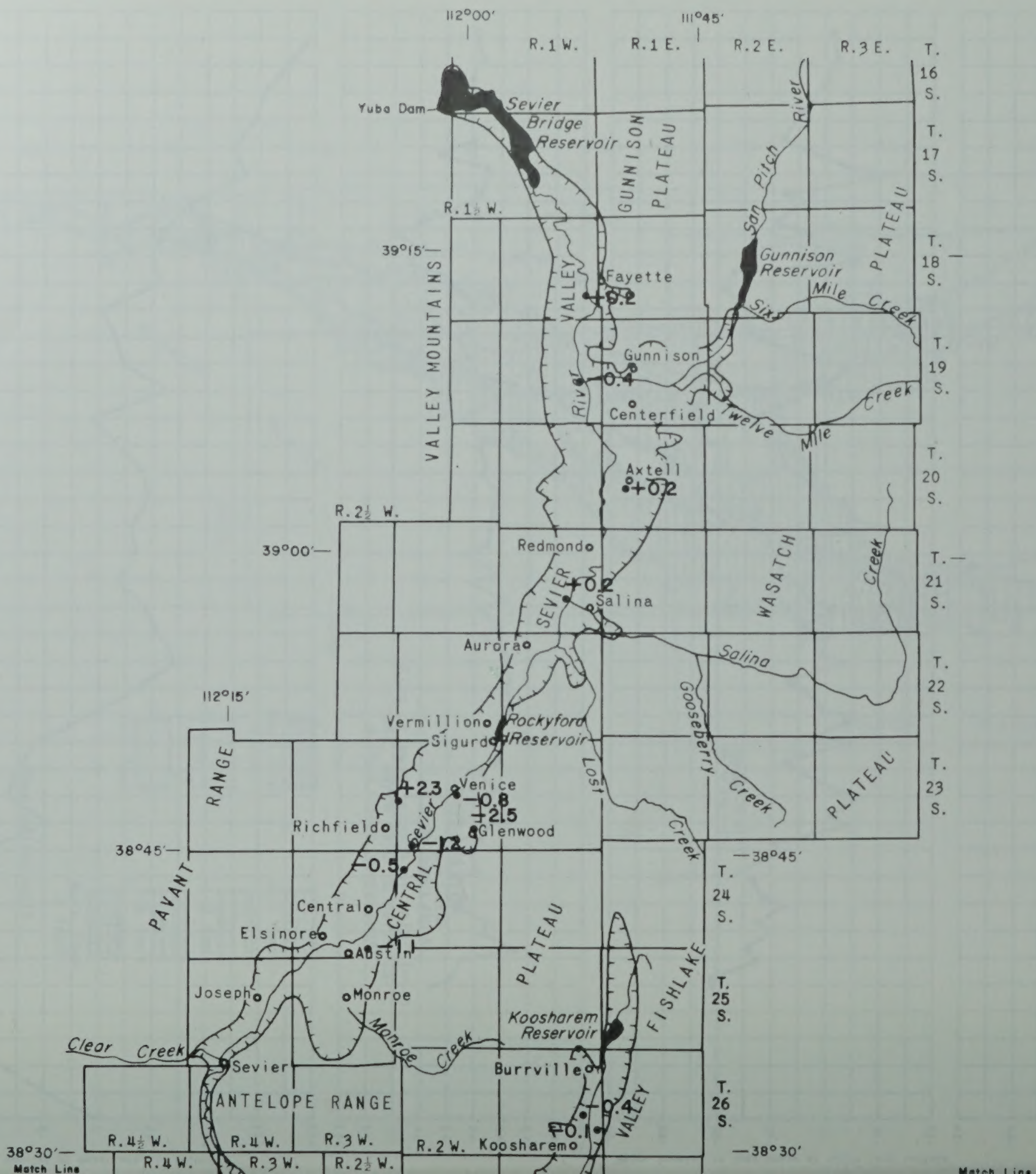


Figure 22.—Relation of water levels in selected wells in Sanpete Valley to cumulative departure from the 1931-60 normal annual precipitation at Manti.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38°30′
Yuba Dam
Sevier Bridge Reservoir
GUNNISON PLATEAU
San Pitch River
Gunnison Reservoir
Six Mile Creek
Twelve Mile Creek
PLATEAU
VALLEY MOUNTAINS
VALLEY
Fayette
+0.2
Gunnison
-0.4
Centerfield
River
Axtell
+0.2
Redmond
SEVIER
+0.2
Salina
WASATCH
Creek
Aurora
Salina
Gooseberry Creek
Lost Creek
Vermillion
Rockyford Reservoir
Sigurd
RANGE
+2.3
Venice
-0.8
+2.5
Glenwood
Richfield
Sevier
-1.2
-0.5
PAVANT
Central
CENTRAL
Elsinore
Austin
-1.1
PLATEAU
Joseph
Monroe
FISHLAKE
Koosharem Reservoir
Clear Creek
Monroe Creek
Sevier
Burrville
ANTELOPE RANGE
-0.4
VALLEY
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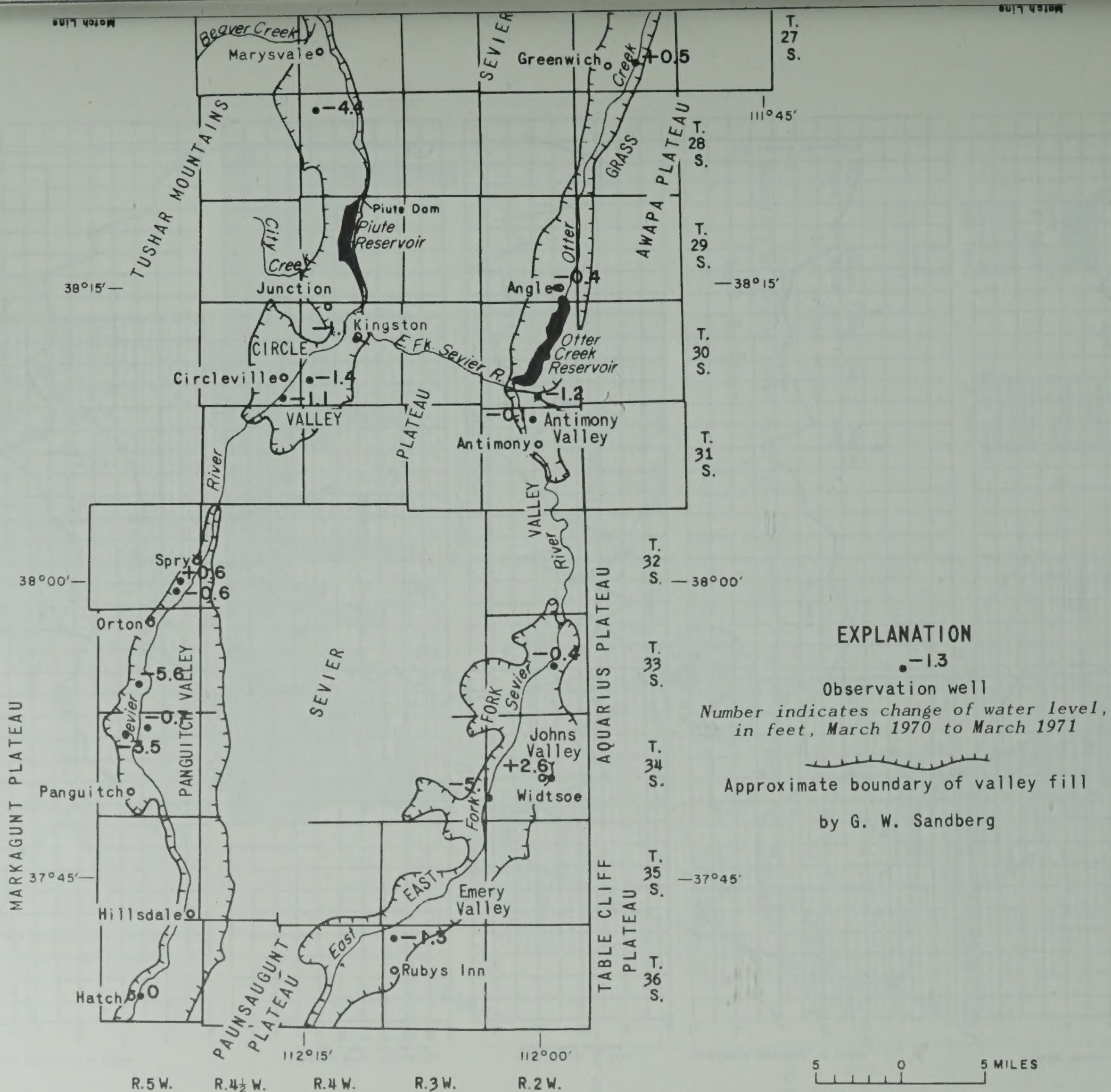

Figure 23.—Map of the upper and central Sevier Valleys showing change of water levels from March 1970 to March 1971.

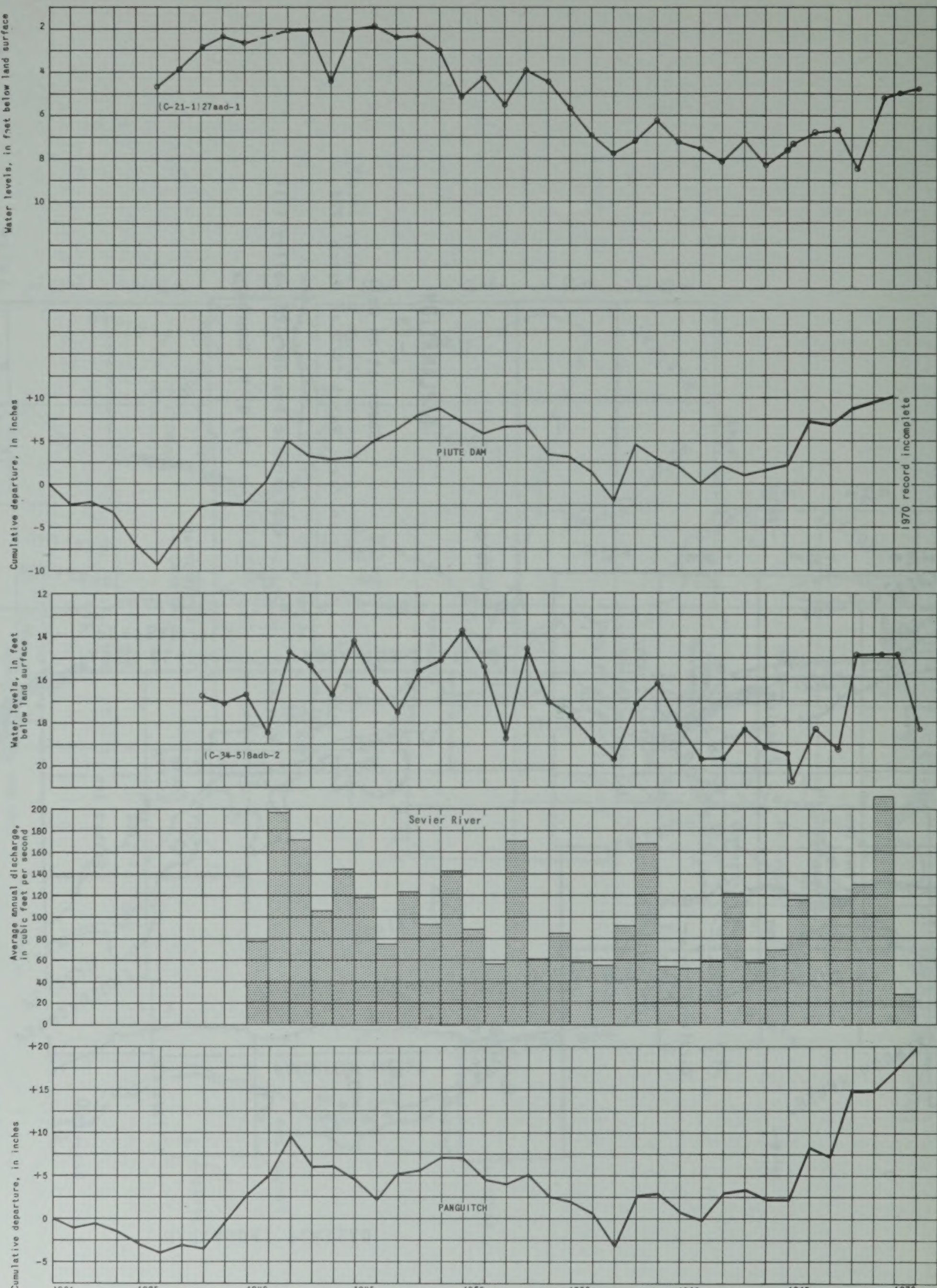

Figure 24.—Relation of water levels in selected wells and of average annual discharge of the Sevier River at Hatch to cumulative departure from the 1931-60 normal annual precipitation at Piute Dam and Panguitch.

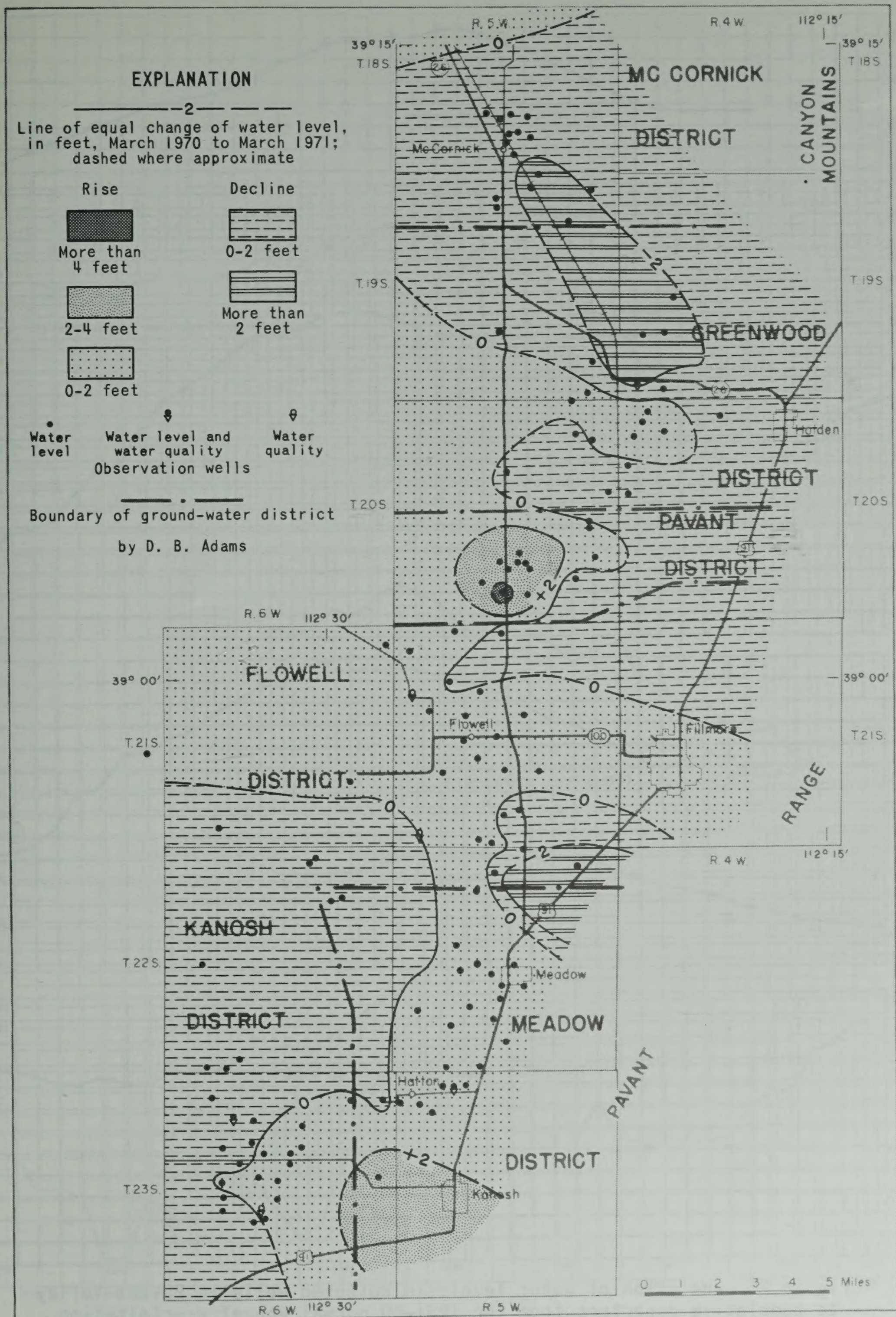

Figure 25.—Map of the Pavant Valley showing change of water levels from March 1970 to March 1971.

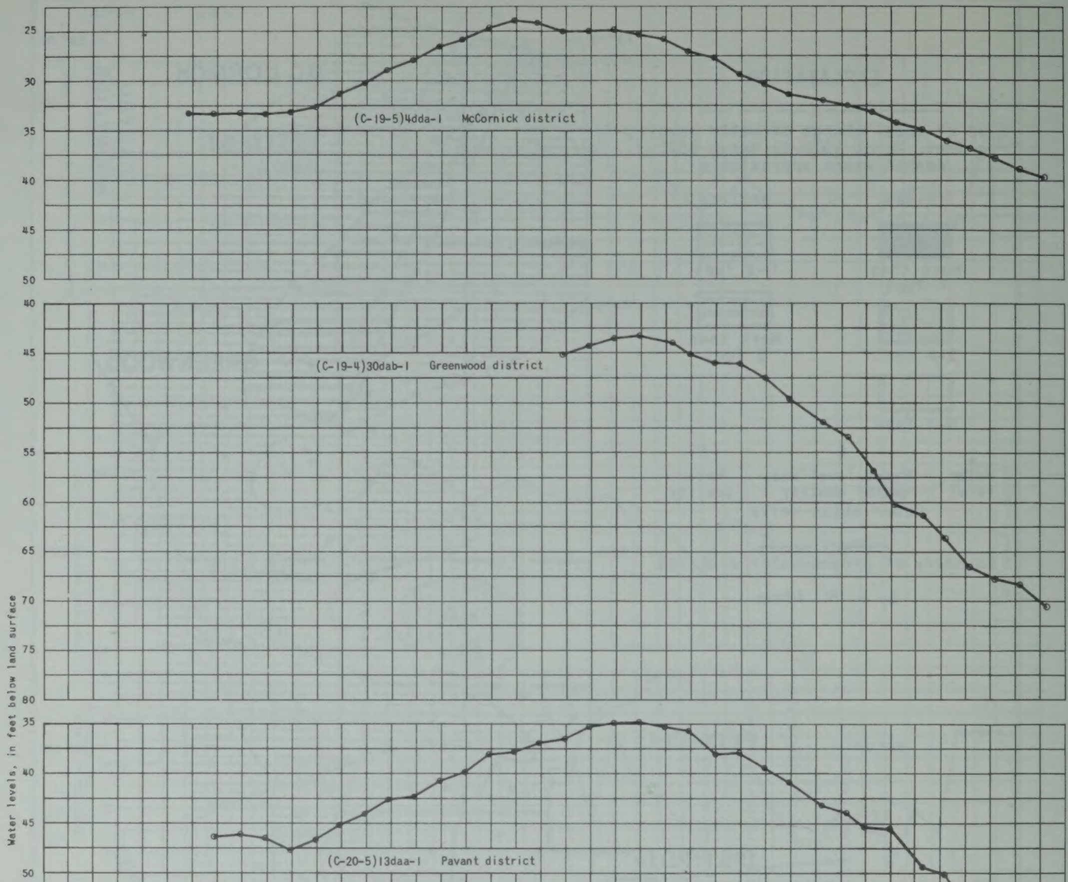

Figure 26.--Relation of water levels in selected wells in Pavant Valley to cumulative departure from the 1931-60 normal annual precipitation at Fillmore.

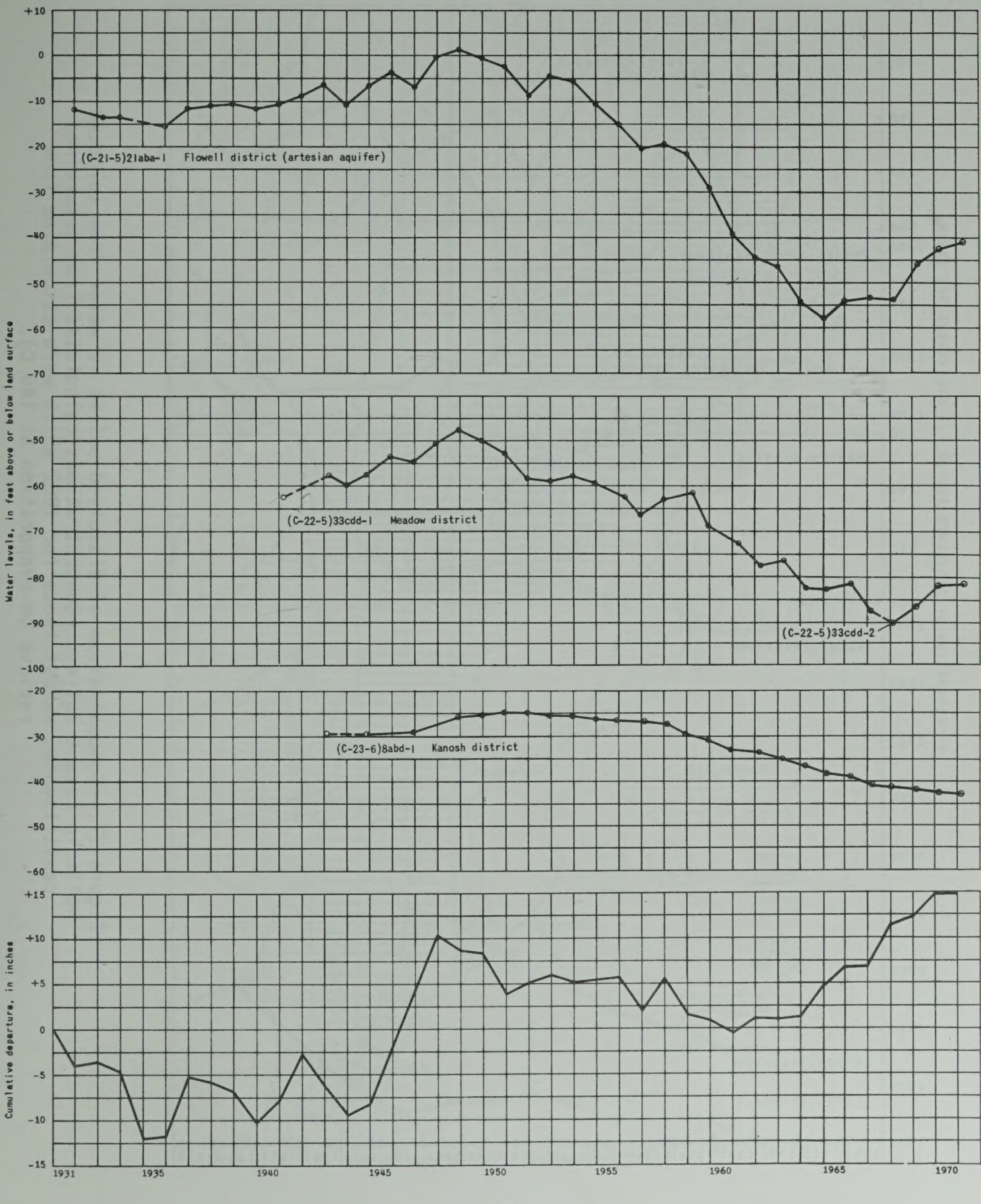

Figure 26.--Continued.

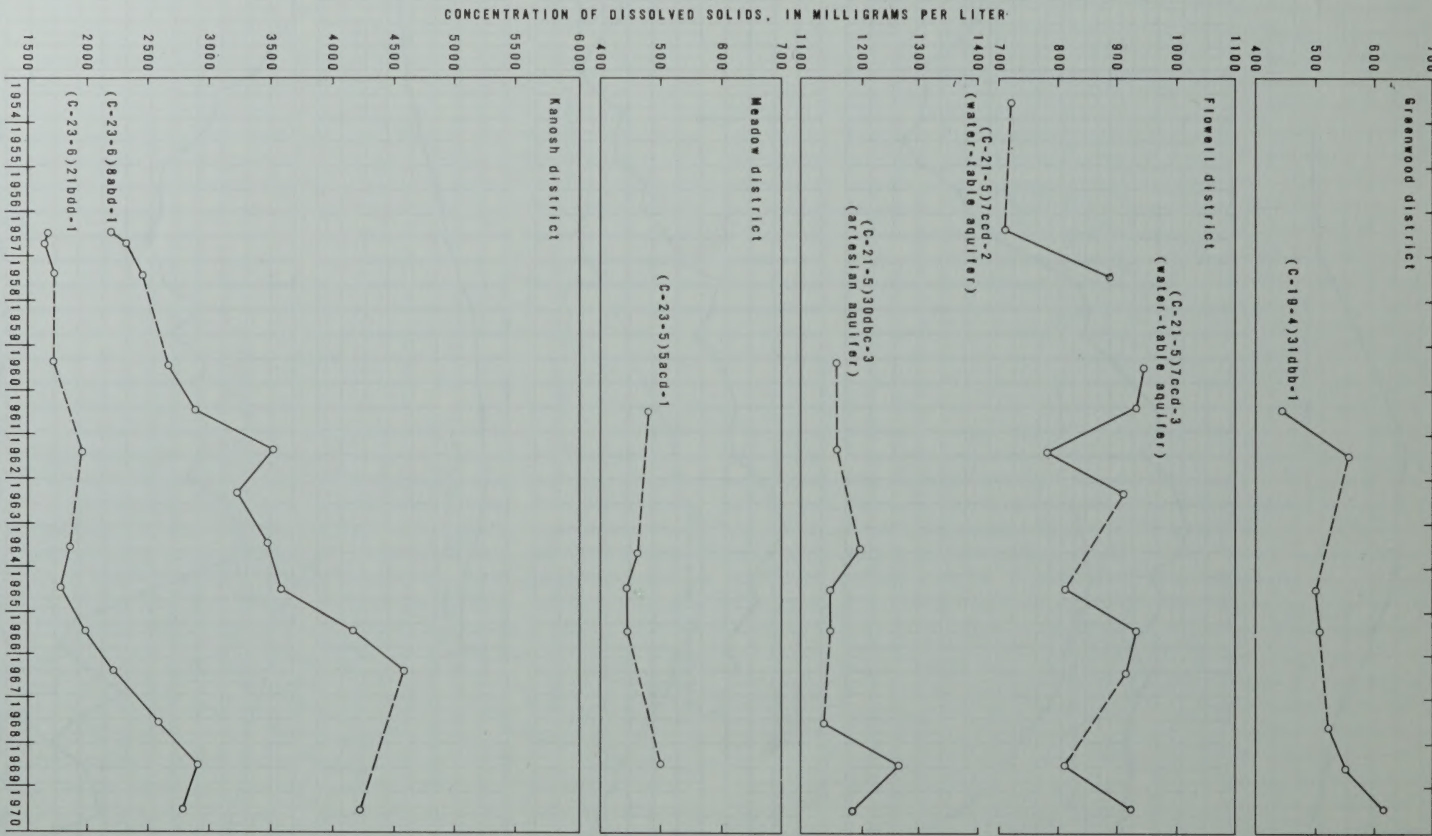

Figure 27.--Concentration of dissolved solids in water from selected wells in Pavant Valley. (Concentrations calculated from determined constituents, except those for 1962 which were calculated from residue on evaporation at 180 C).

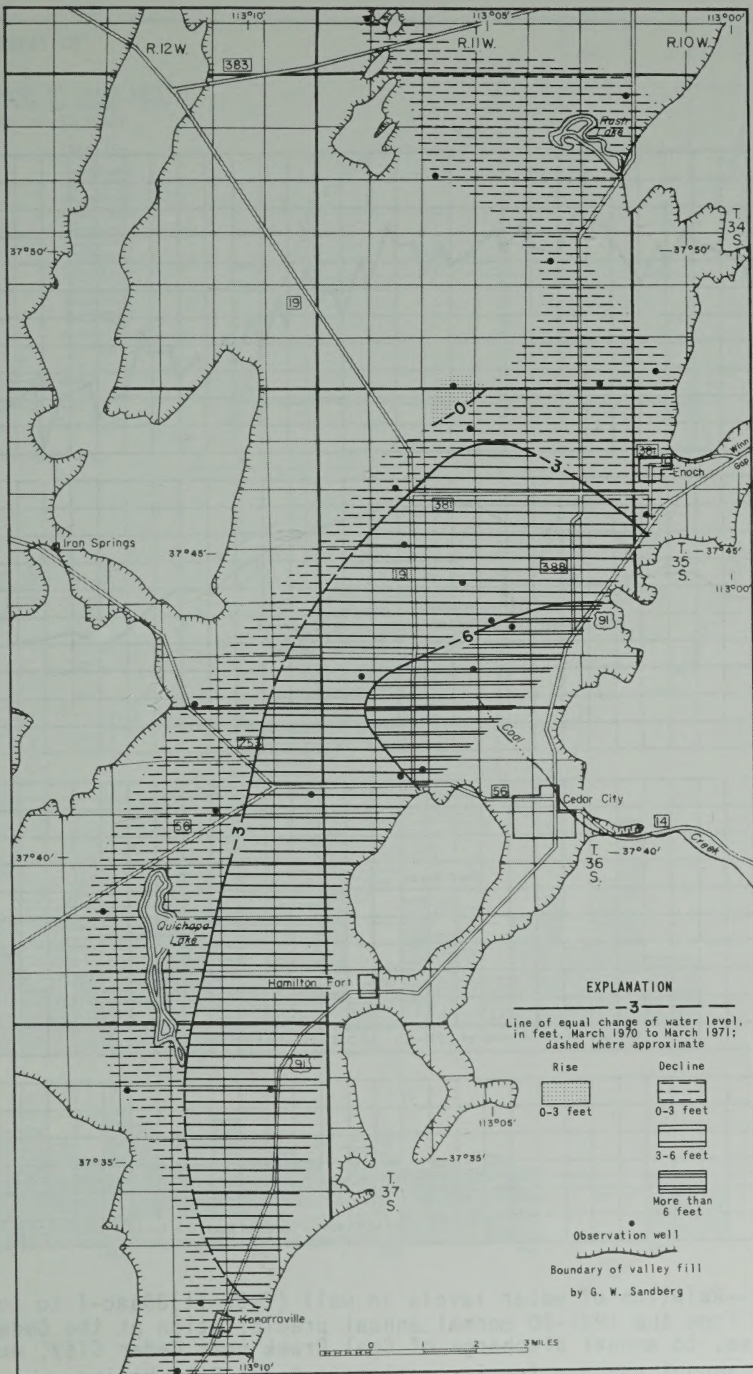

Figure 28.—Map of Cedar City Valley showing change of water levels from March 1970 to March 1971.

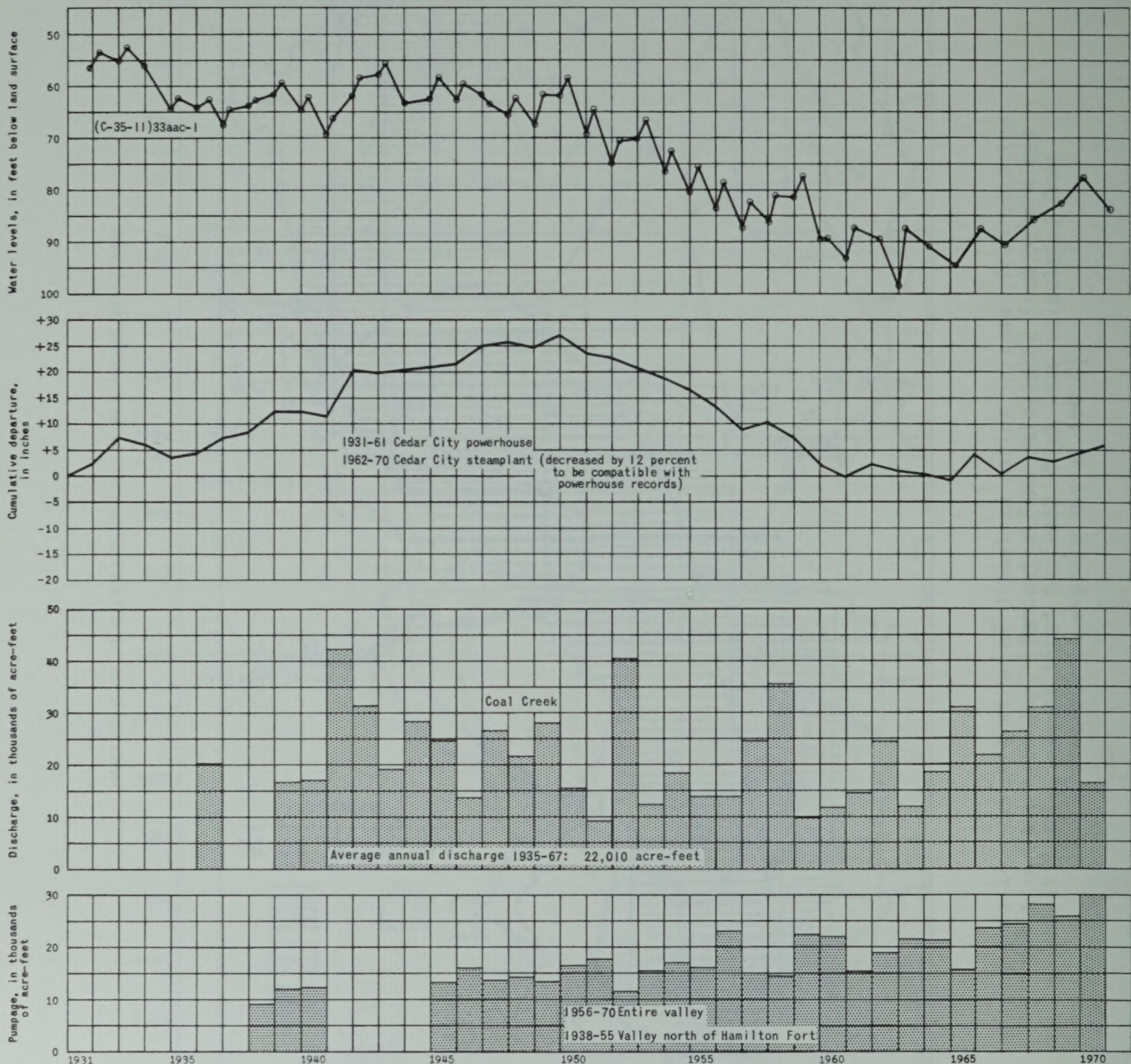

Figure 29.--Relation of water levels in well (C-35-11)33aac-1 to cumulative departure from the 1931-60 normal annual precipitation at the Cedar City powerhouse, to annual discharge of Coal Creek near Cedar City, and to annual pumpage for irrigation in Cedar City Valley.

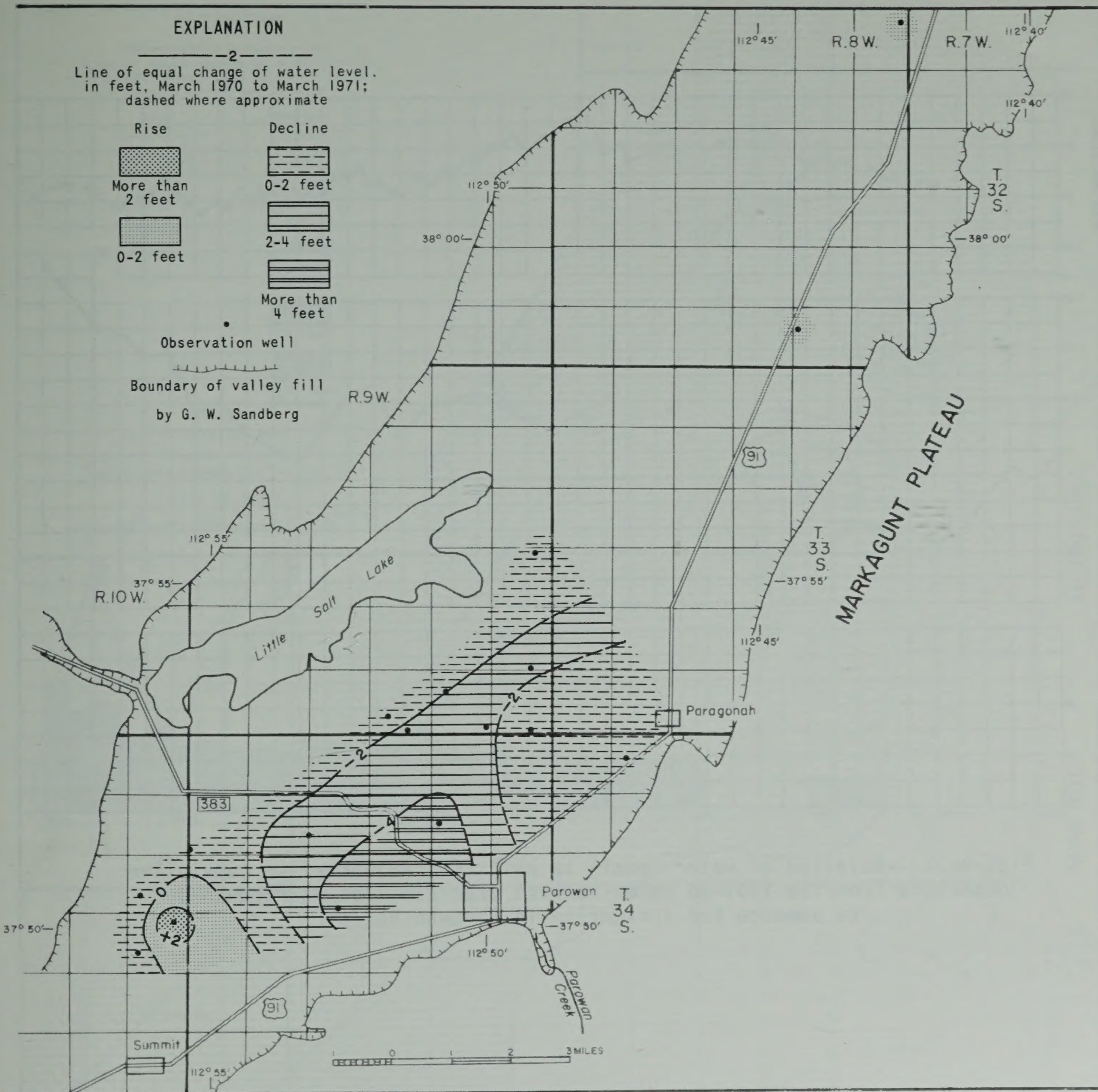

Figure 30.—Map of Parowan Valley showing change of water levels from March 1970 to March 1971.

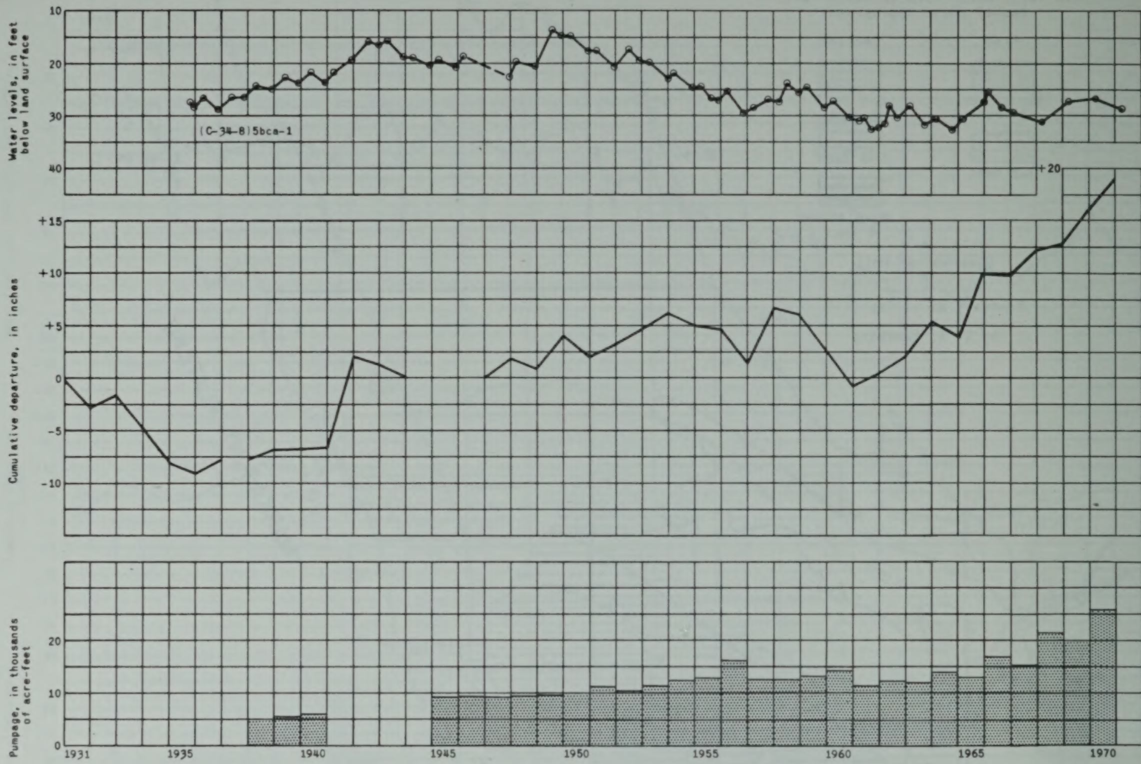

Figure 31.--Relation of water levels in well (C-34-8)5bca-1 to cumulative departure from the 1931-60 normal annual precipitation at Parowan and to pumpage for irrigation in Parowan Valley.

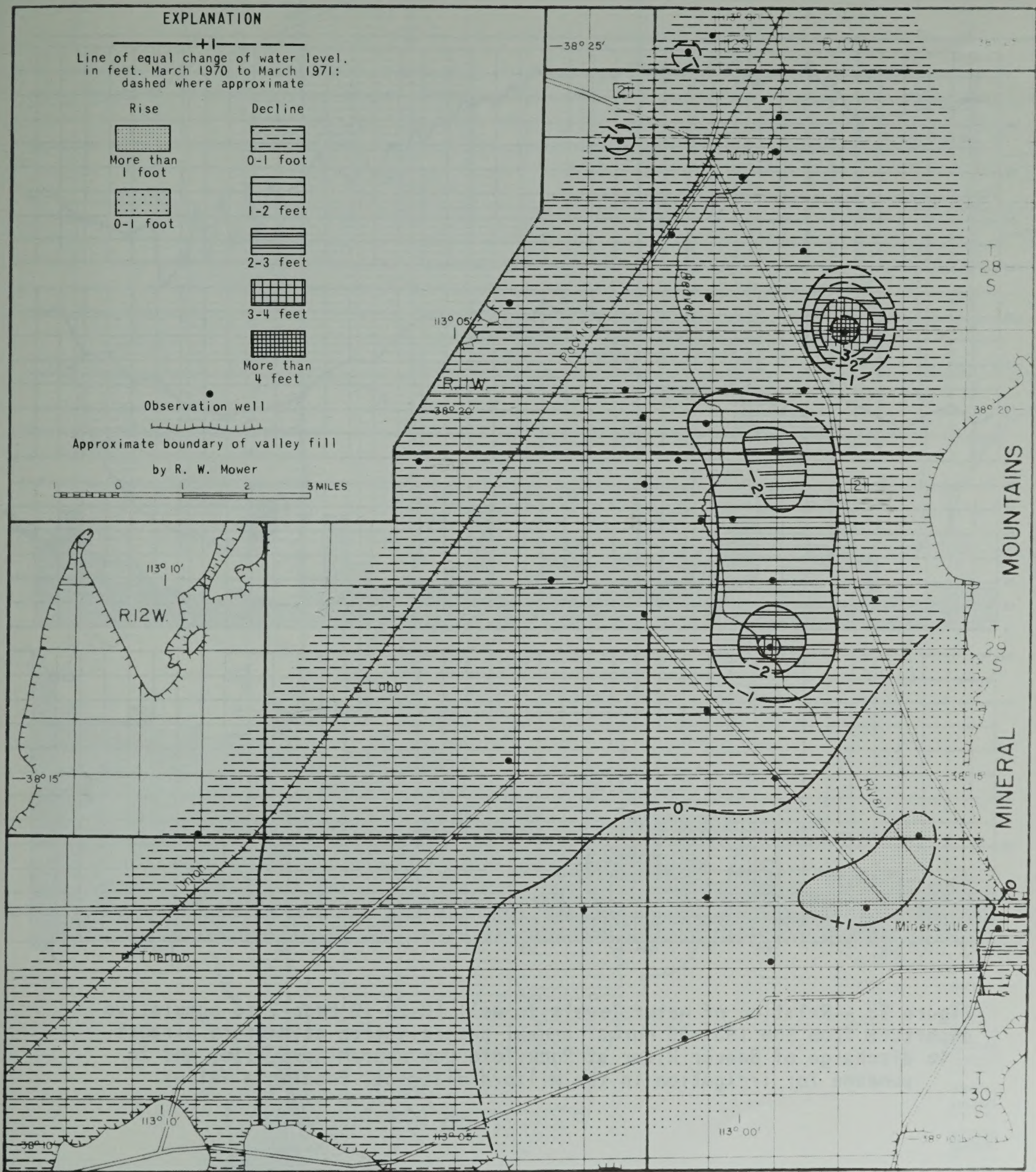

Figure 32.—Map of the Milford district, Escalante Valley, showing change of water levels from March 1970 to March 1971.

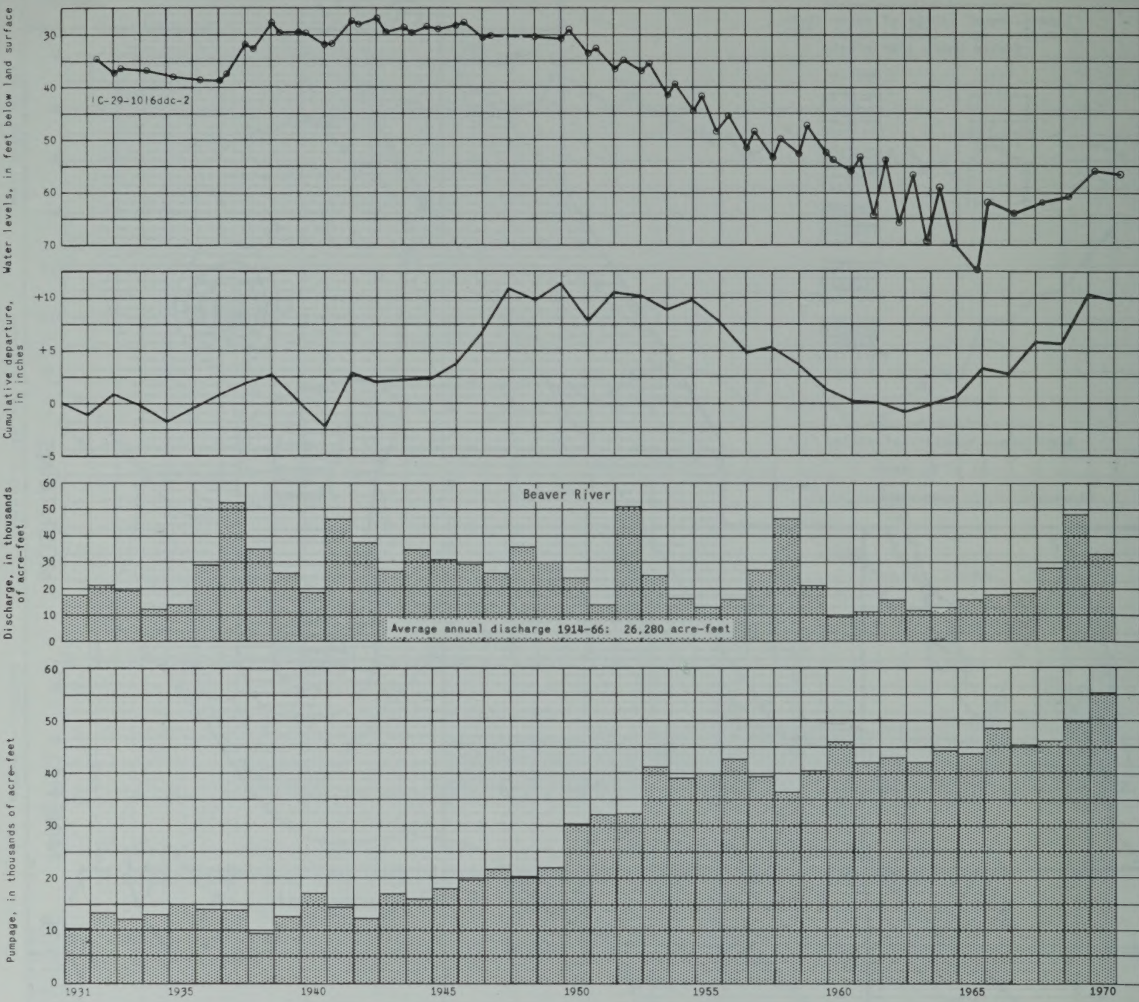

Figure 33.--Relation of water levels in well (C-29-10)6ddc-2 to cumulative departure from the 1931-60 normal annual precipitation at Milford airport, to discharge of Beaver River at Rockyford Dam near Minersville, and to pumpage for irrigation in the Milford district, Escalante Valley.

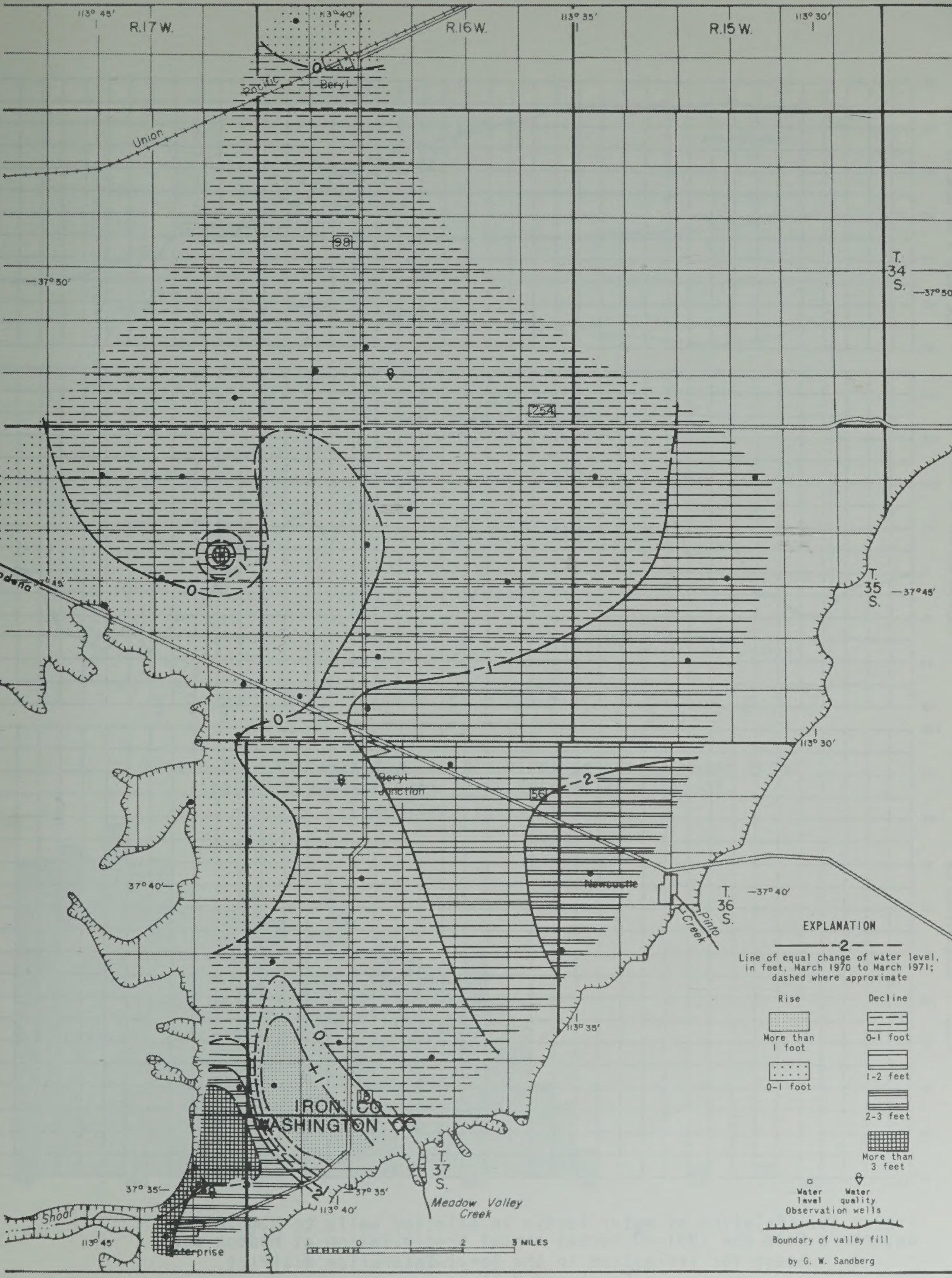

Figure 34.—Map of the Beryl-Enterprise district, Escalante Valley, showing change of water levels from March 1970 to March 1971.

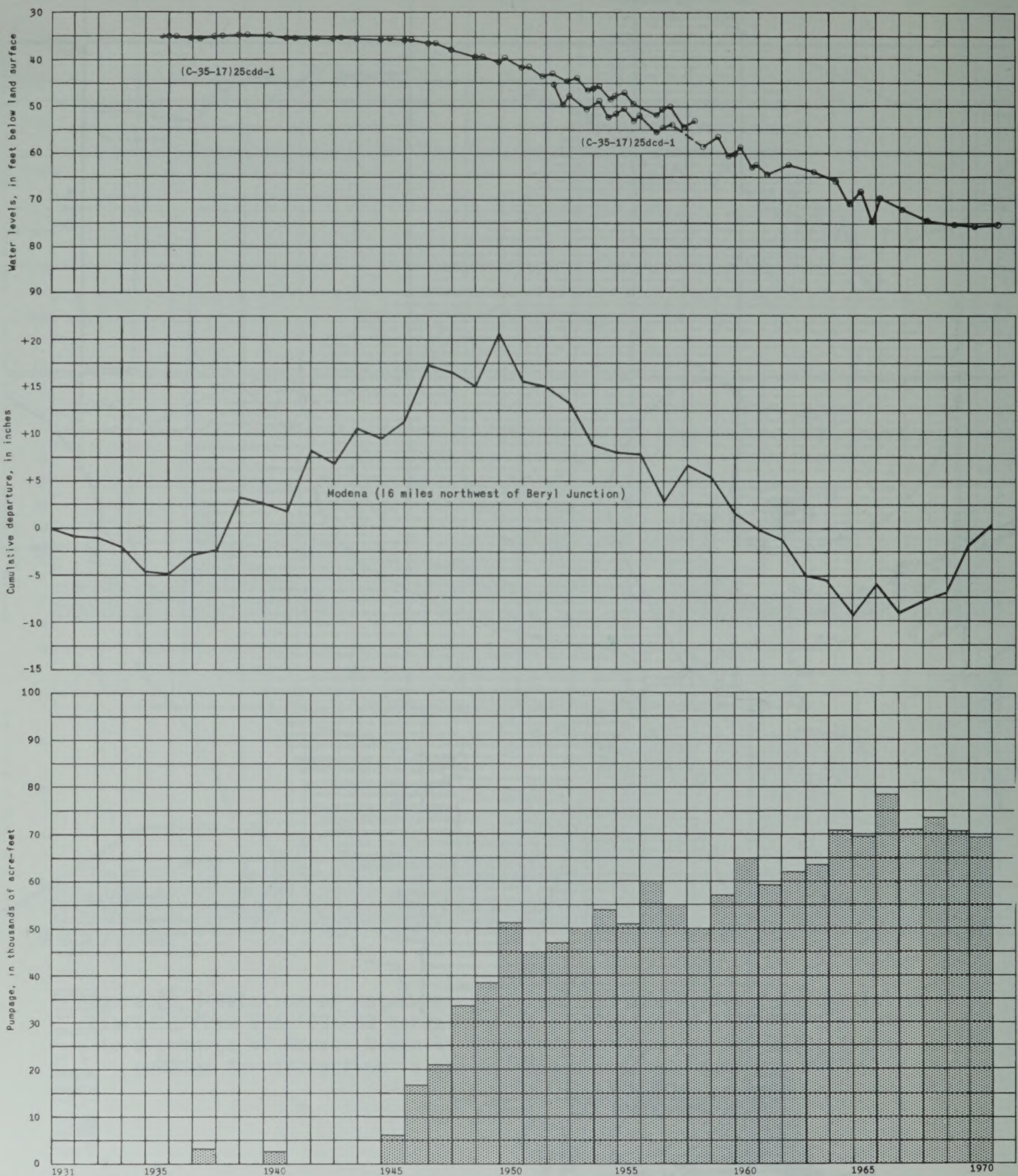

Figure 35.—Relation of water levels in selected wells to cumulative departure from the 1931-60 normal annual precipitation at Modena and to pumpage for irrigation in the Beryl-Enterprise district, Escalante Valley.

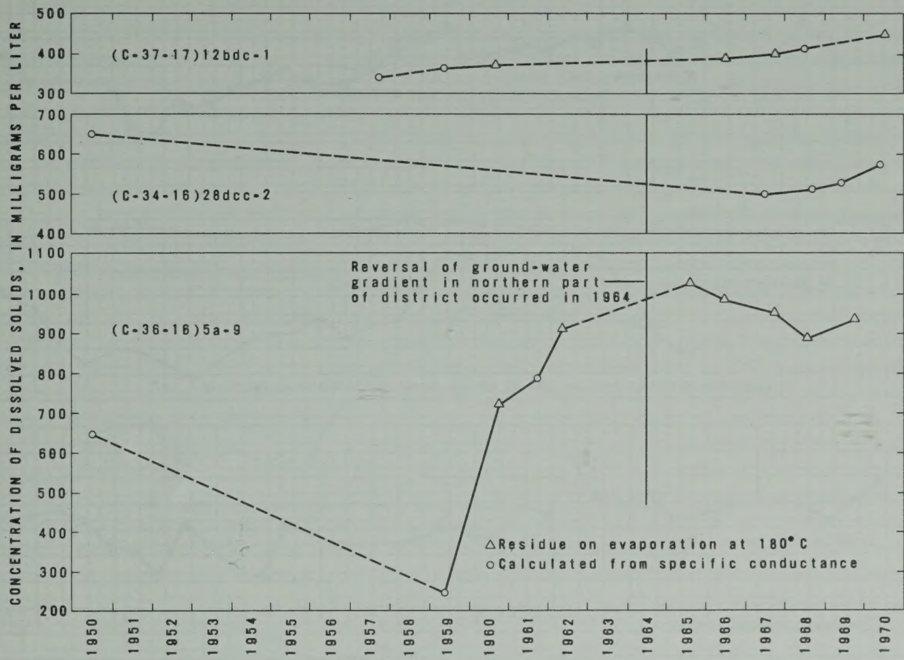

Figure 36.—Concentration of dissolved solids in water from selected wells in the Beryl-Enterprise district, Escalante Valley.

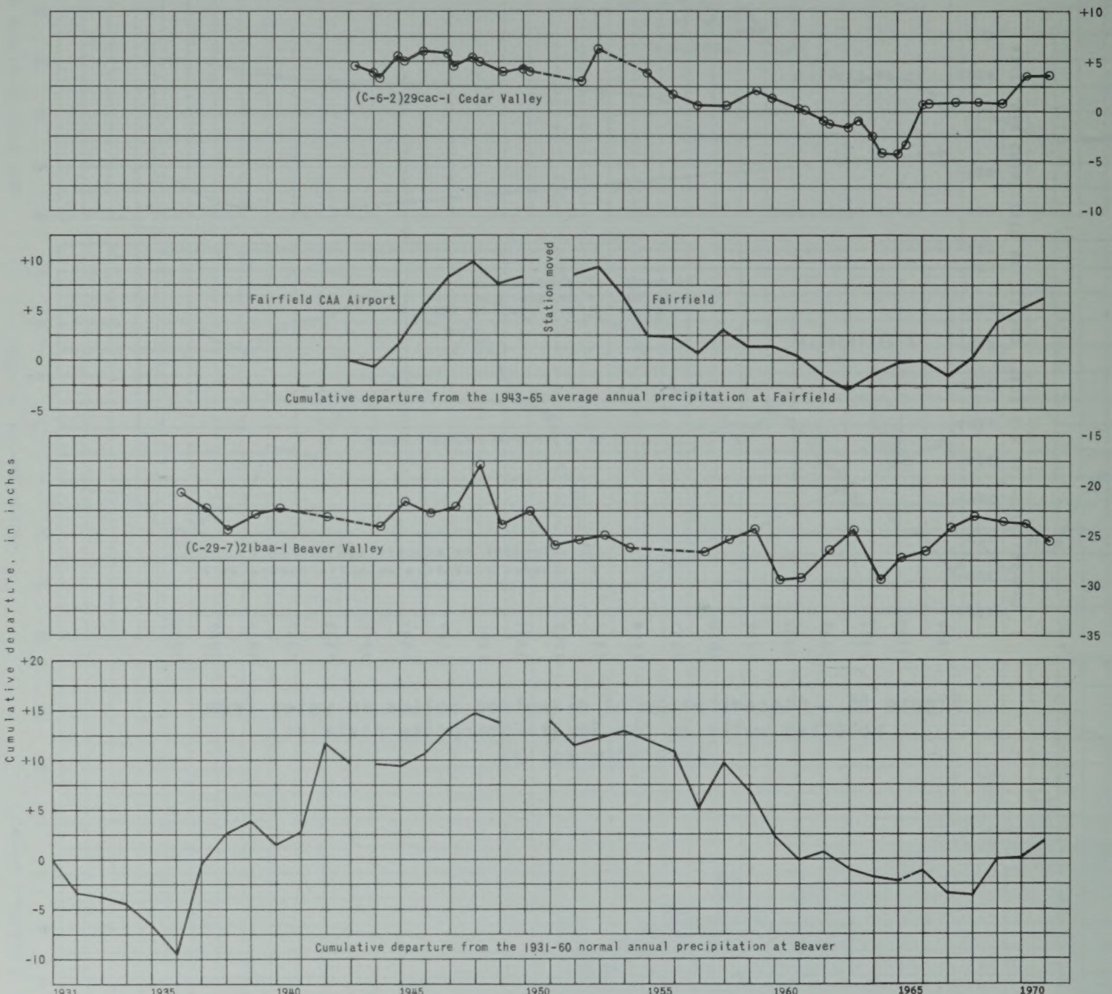

Figure 37.—Relation of water levels in wells in selected areas of Utah to cumulative departure from the average annual precipitation at sites in or near those areas.

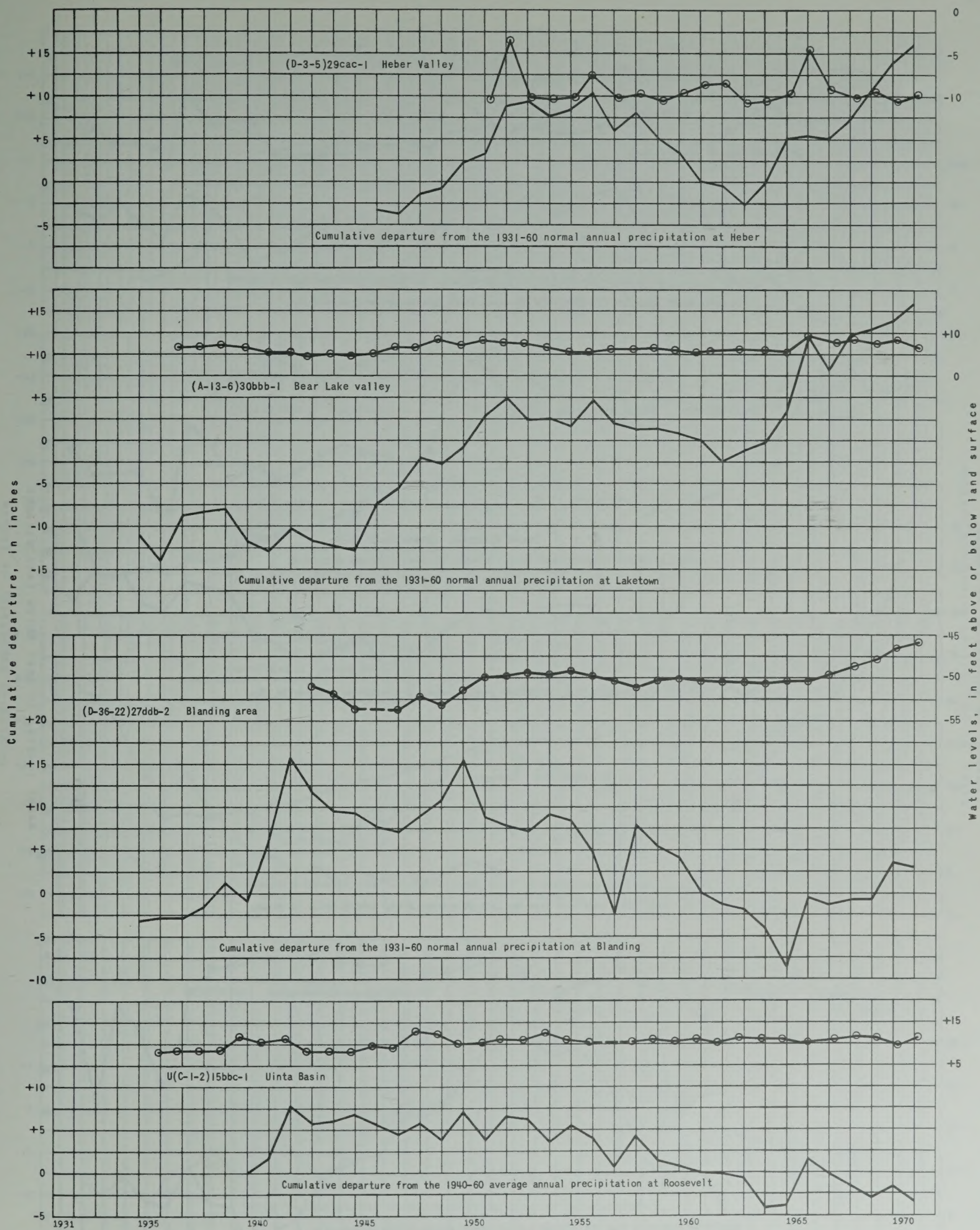

Figure 37.—Continued.

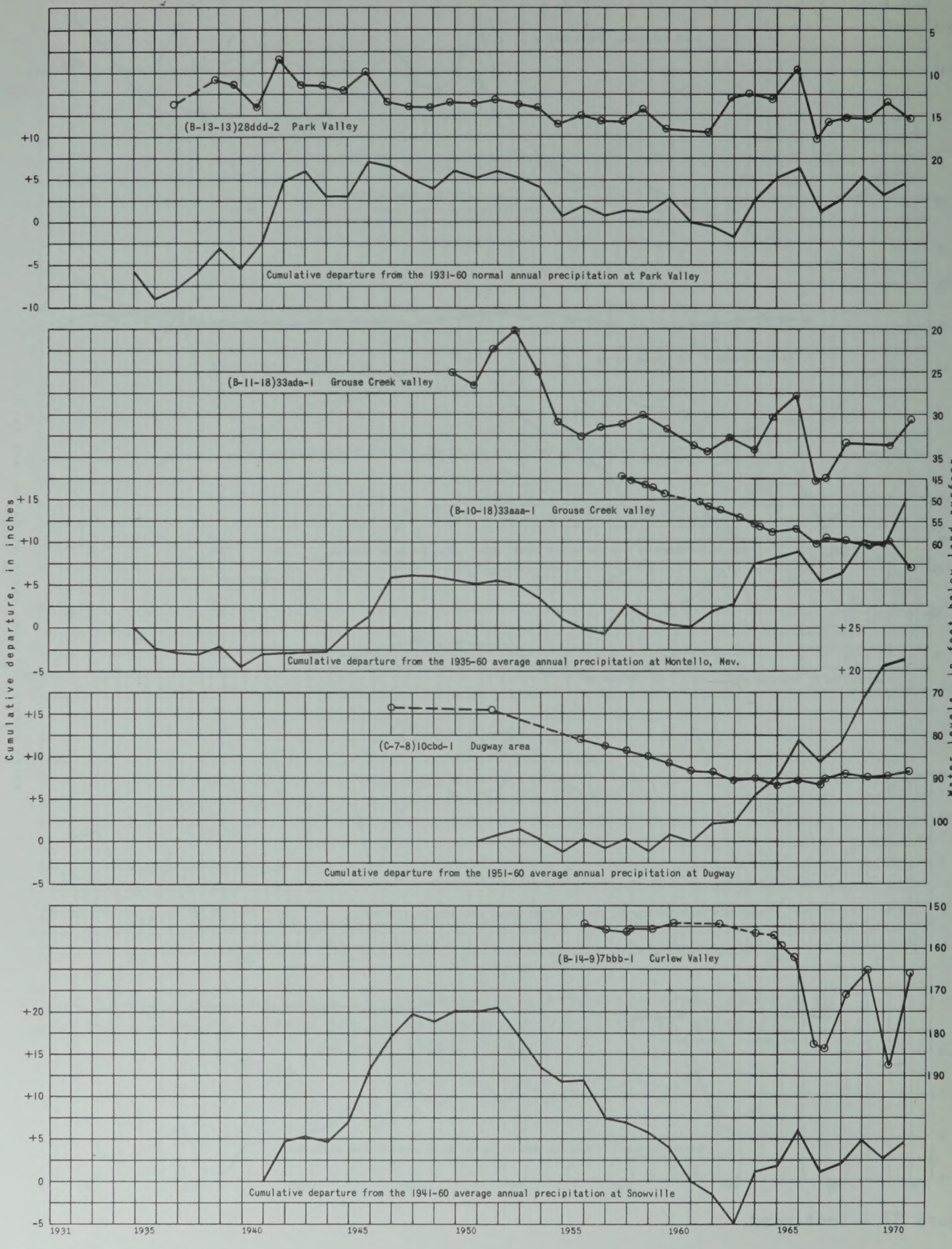

Figure 37.— Continued.

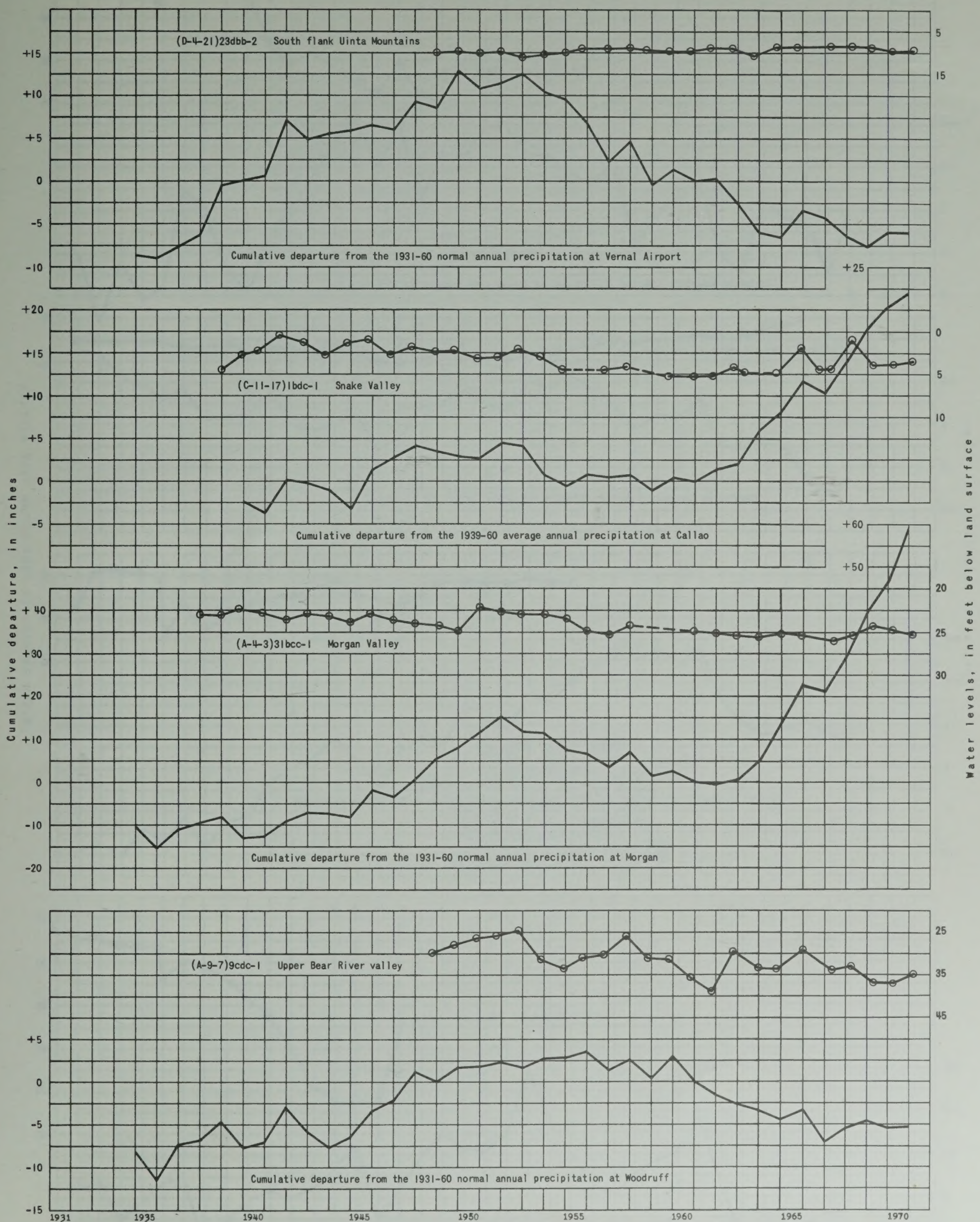

Figure 37.—Continued.

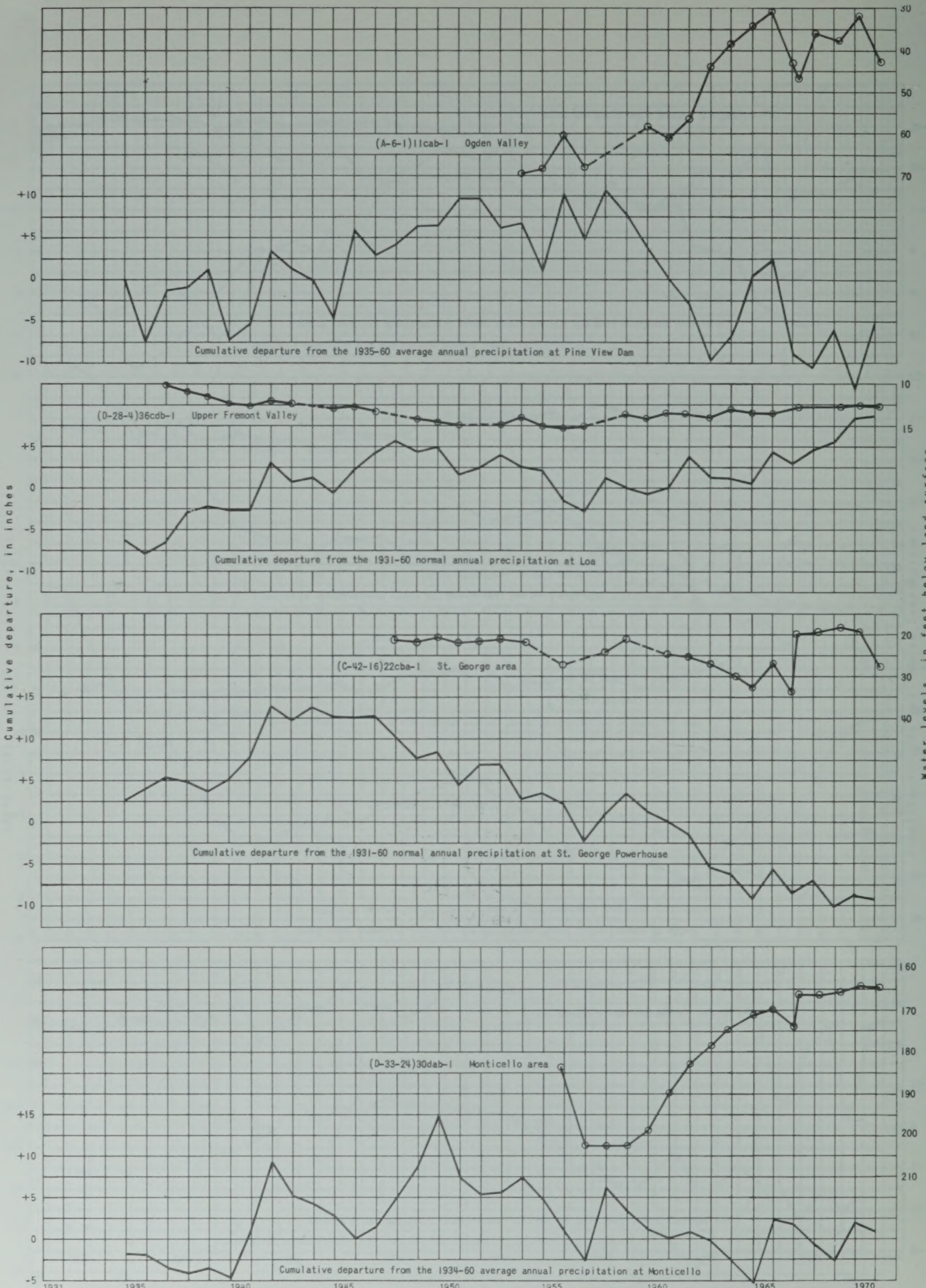

Figure 37.— Continued.